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THE ANATOMICAL RECORD

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DECEMBER 25, 1935

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SUPPLEMENT

THE ANATOMICAL RECORD, VOL. 64, NO. 1, AND SUPPLEMENT NO. 1

AMERICAN SOCIETY OF ZOÖLOGISTS

Officers for 1935

President.....R. W. HEGNER
Vice-President.....SEWALL WRIGHT
Secretary.....H. B. GOODRICH
Treasurer.....B. H. WILLIER

Executive Committee

(In addition to the four officers)

H. V. NEAL.....to serve until December, 1935
FERNANDUS PAYNE.....to serve until December, 1936
W. C. CURTIS.....to serve until December, 1937
CHARLES ZELENY.....to serve until December, 1938
A. H. STURTEVANT.....to serve until December, 1939

Representative of the Society in the Division of Biology and Agriculture of the National Research Council

To serve until July 1, 1938.....L. V. HEILBRUNN
C. R. MOORE, Alternate

Representatives of the Society on the Council of the American Association for the Advancement of Science

R. A. BUDINGTON J. H. BODINE

Representatives of the Society on the Council of the Union of American Biological Societies

F. L. HISAW A. C. REDFIELD

Representatives of the Society on the Advisory Editorial Board of "Biological Abstracts"

H. S. PRATT AND G. K. NOBLE.....*Taxonomy*
D. H. TENNENT.....*General Embryology*
M. H. JACOBS.....*General Physiology*

Representative on the Executive Committee of the Commission for the Standardization of Biological Stains

S. I. KORNHAUSER

Managing Editor of the Journal of Morphology

To serve until December, 1936.....C. E. MCCLUNG

Members of Editorial Board of the Journal of Morphology

To serve until December, 1935

L. R. CLEVELAND F. L. HISAW FRANZ SCHRADER

To serve until December, 1936

CHARLES ZELENY J. F. DANIEL J. S. NICHOLAS

To serve until December, 1937

D. H. TENNENT L. C. DUNN C. G. HARTMAN

AMERICAN SOCIETY OF ZOÖLOGISTS

CONSTITUTION

ARTICLE I

NAME AND OBJECT

Section 1. The Society shall be called the "American Society of Zoölogists."

Sec. 2. The object of the Society shall be the association of workers in the field of zoölogy for the presentation and discussion of new or important facts and problems in that science and for the adoption of such measures as shall tend to the advancement of zoölogical science.

ARTICLE II

MEMBERSHIP

Section 1. The membership of the Society shall consist of two classes:

a. Associate membership open to all actively engaged in the field of zoölogy who have had training in zoölogy equivalent to that required for the doctorate degree.

b. Active membership open to those who hold the doctor's degree in zoölogy or who have done work equivalent thereto, and who, in addition to the usual requirements for this degree, have published the results of substantial zoölogical research.

Sec. 2. Election to membership in the Society shall be upon recommendation of the Executive Committee.

Sec. 3. Associate members shall not hold office or vote, but may present papers before the Society without introduction. Associate members shall receive all literature issued by the Society, including the proceedings of the Society, and shall have the same privileges as active members in journal subscriptions.

Sec. 4. Associate members may be elected to active membership in the usual way when the research requirements of active membership have been met.

ARTICLE III

OFFICERS

Section 1. The officers of the Society shall be a President, a Vice-President, a Secretary, a Treasurer, and the members at large of the Executive Committee.

Sec. 2. The Executive Committee shall consist of the President, the Vice-President, the Secretary, the Treasurer, and five members elected from the Society at large. Of these five members, one shall be elected each year to serve five years. If any member at large shall be elected to any other office, a member at large shall be elected at once to serve the remainder of his term.

Sec. 3. These officers shall be elected by ballot at the annual meeting of the Society and their official terms shall commence with the close of the annual meeting, except that the Secretary and the Treasurer shall be elected triennially and shall serve for three years.

Sec. 4. The officers named in Section 1 shall discharge the duties usually assigned to their respective offices. (See by-laws.)

Sec. 5. Vacancies in the board of officers, occurring from any cause, may be filled by election by ballot at any meeting of the Society. A vacancy in either the Secretaryship or the Treasurership occurring in the interval of the meetings of the Society may be filled, until the next annual meeting, by appointment by the Executive Committee.

Sec. 6. At the annual meeting the President shall name a nominating committee consisting of three active members. It shall be the duty of this committee to nominate officers of the Society, including the permanent representatives which the Society is asked to name to various boards and councils. This committee shall make its nominations to the Secretary at least four months before the next annual meeting. Additional nominations for any office may be made in writing to the Secretary by any five members at any time previous to balloting.

Article IV

Meetings of the Society

Section 1. Unless previously determined by the Society, the time and place of the annual meeting shall be determined by the Executive Committee. Special meetings may be called and arranged for by the Executive Committee. Notices of such meetings shall be mailed to all members of the Society at least two weeks before the date set for the meeting.

Sec. 2. Sections of the Society may be organized in any locality by not less than ten members, for the purpose of holding meetings for the presentation of scientific papers. Such sections shall have the right to elect their own officers and also associate members; provided, however, that associate membership in any section shall not confer membership in the Society.

Article V

Quorum

Twenty-five members shall constitute a quorum of the Society and four a quorum of the Executive Committee.

Article VI

Changes in the Constitution

Amendments to this Constitution may be adopted at any meeting of the Society upon approval of two-thirds of the members voting, subject to the following conditions:

a. The proposed amendment must be in writing and signed by at least five members of the Society.

b. This signed proposal must be in the hands of the Secretary at least one month before the meeting of the Society at which it is to be considered.

c. The Secretary shall mail copies of the proposed amendment to the members of the Society at least two weeks before the meeting.

d. Members unable to attend may submit their votes in writing to the Secretary.

BY-LAWS

ARTICLE I

DUES

Section 1. The annual dues for active and associate members, unless remitted or changed by the vote of the Society, shall be two dollars.

Sec. 2. Any member in arrears of dues for two years should be dropped by the Executive Committee. Upon payment of arrearage he shall be reinstated.

ARTICLE II

PRESIDENT

Section 1. The President shall preside at scientific sessions and at the business meetings.

Sec. 2. He shall also appoint the committees prescribed by the constitution and by-laws.

ARTICLE III

VICE-PRESIDENT

Section 1. The Vice-President shall preside at sessions designated by the President.

Sec. 2. He shall also assume the duties of the President in the latter's absence.

ARTICLE IV

SECRETARY

Section 1. The Secretary shall keep the records of the Society.

Sec. 2. He shall be responsible for all arrangements for the meetings, including the appointment of local committees.

Sec. 3. Whenever the proper officers of a number of related societies shall have a conference covering matters of mutual interest to the several societies, he shall act as the delegate or representative of this Society.

Sec. 4. He shall make such purchases and employ such assistance as will, in his judgment, expedite the business of the Society, and

Sec. 5. He shall be reimbursed out of the funds of the Society for expenses incurred in attending meetings of the Society.

Article V

TREASURER

Section 1. The Treasurer shall be in charge of the funds of the Society.

Sec. 2. At the annual business meeting of the Society he shall present a statement to date of the funds of the Society.

Sec. 3. He shall make such purchases and employ such assistance as will, in his judgment, expedite the business of the Society.

Article VI

AUDITING COMMITTEE

The President shall annually appoint an auditing committee of two, who shall audit and report upon the financial record and statement of the Treasurer at the meeting for which they were appointed.

Article VII

PROGRAM RULES

In matters relating to programs for annual meetings, the following rules shall be observed:

Section 1. Titles and abstracts of papers to be presented by any method at the annual meeting must be sent to the Secretary in duplicate before the final date set by him. The length, form, and arrangement of the abstracts must comply with the requests of the Secretary in order to insure prompt publication by The Wistar Institute. The titles and abstracts of papers which do not conform to such requests or papers which are received late may be presented by title only.

Sec. 2. Titles shall be listed in groups according to subject matter, the groups to be determined by the Secretary.

Sec. 3. Whenever conditions require, the Secretary shall schedule two or more groups for the same hour and arrange the program to bring together papers on subjects of more general interest for meetings of the whole Society.

Sec. 4. Each member may have not more than fifteen minutes of the time of the Society at the annual meeting. This time may be used by him to present one or more papers personally or to introduce papers of non-members.

Sec. 5. All papers not read when called for as listed shall be placed at the end of the group list, and if not read when called for the second time, shall be read by title only.

Sec. 6. The titles of 'introduced' papers may be listed in the groups after the titles of papers to be read by members.

LIST OF FORMER OFFICERS

American Morphological Society

President	*Vice-President*	*Secretary-Treasurer*
1890—E. B. Wilson	.....	J. P. McMurrich
1891—C. O. Whitman	E. L. Mark	J. P. McMurrich
1892—C. O. Whitman	H. F. Osborn	J. P. McMurrich
1893—C. O. Whitman	E. B. Wilson	J. P. McMurrich
1894—C. O. Whitman	W. B. Scott	G. H. Parker
1895—E. B. Wilson	W. B. Scott	G. H. Parker
1896—E. L. Mark	H. F. Osborn	G. H. Parker
1897—C. S. Minot	S. I. Smith	G. H. Parker
1898—H. F. Osborn	T. H. Morgan	G. H. Parker
1899—E. G. Conklin	W. M. Wheeler	Bashford Dean
1900—T. H. Morgan	H. C. Bumpus	J. S. Kingsley
1901—J. S. Kingsley	E. A. Andrews	T. H. Montgomery
1902—H. C. Bumpus	G. H. Parker	M. M. Metcalf

Additional Members of the Executive Committee

1891—E. B. Wilson	1897—J. S. Kingsley
H. F. Osborn	Bashford Dean
1892—E. L. Mark	1898—C. B. Davenport
T. H. Morgan	F. R. Lillie
1893—T. H. Morgan	1899—J. P. McMurrich
C. B. Davenport	G. H. Parker
1894—E. A. Andrews	1900—F. R. Lillie
F. H. Herrick	Jacob Reighard
1895—T. H. Morgan	1901—C. F. W. McClure
S. Watase	C. W. Hargitt
1896—E. G. Conklin	1902—H. S. Jennings
William Patten	R. G. Harrison

American Society of Zoölogists

EASTERN BRANCH	*President*	CENTRAL BRANCH
G. H. Parker	1903	Jacob Reighard
E. A. Andrews	1904	C. H. Eigenmann
W. E. Castle	1905	F. R. Lillie
W. E. Castle	1906	C. C. Nutting
C. B. Davenport	1907	S. A. Forbes
W. M. Wheeler	1908	E. A. Birge
H. S. Jennings	1909	E. A. Birge
T. H. Montgomery	1910	C. E. McClung
H. V. Wilson	1911	George Lefevre
A. G. Mayer	1912	H. B. Ward
Raymond Pearl	1913	H. B. Ward

LIST OF FORMER OFFICERS

EASTERN BRANCH	*Vice-President*	CENTRAL BRANCH
Jacob Reighard	1903	H. F. Nachtrieb
W. E. Castle	1904	S. J. Holmes
William Patten	1905	William A. Locy
William Patten	1906	George Lefevre
F. H. Herrick	1907	H. B. Ward
H. S. Jennings	1908	M. F. Guyer
H. V. Wilson	1909	M. F. Guyer
H. H. Wilder	1910	H. F. Nachtrieb
H. E. Crampton	1911	R. H. Walcott
G. A. Drew	1912	C. M. Child
Alex. Petrunkevitch	1913	C. M. Child

Secretary-Treasurer

G. A. Drew	1903	Frank Smith
G. A. Drew	1904	F. R. Lillie
H. S. Pratt	1905	C. E. McClung
H. S. Pratt	1906	T. G. Lee
C. J. Herrick	1907	T. G. Lee
L. L. Woodruff	1908	T. G. Lee
L. L. Woodruff	1909	Charles Zeleny
H. W. Rand	1910	H. V. Neal
Raymond Pearl	1911	H. V. Neal
J. H. Gerould	1912	W. C. Curtis
Caswell Grave	1913	W. C. Curtis

Executive Committeemen

F. R. Lillie	Herbert Osborn
T. H. Montgomery	C. H. Eigenmann
H. C. Bumpus	J. G. Needham
H. S. Jennings	S. J. Holmes
E. A. Andrews	W. A. Locy
W. R. Coe	C. M. Child
G. A. Drew	R. H. Walcott
M. M. Metcalf	W. C. Curtis
D. H. Tennent	Oscar Riddle
R. G. Harrison	H. B. Ward
H. E. Jordan	Chauncey Juday
C. E. McClung	H. W. Norris
George Lefevre	C. E. McClung
T. G. Lee	H. F. Nachtrieb

American Society of Zoölogists (Amalagated)

	President	*Vice-President*	*Executive Committeemen*
1914.	C. E. McClung	M. F. Guyer	H. E. Jordan—1 year
1915.	W. A. Locy	W. E. Ritter	H. F. Nachtrieb—2 years
1916.	D. H. Tennent	Charles Zeleny	H. V. Wilson—3 years
1917.	M. M. Metcalf	Charles Zeleny	George Lefevre—4 years
1918.	George Lefevre	L. L. Woodruff	A. F. Shull—5 years
1919.	C. M. Child	H. H. Wilder	D. H. Tennent—5 years
1920.	Gilman A. Drew	Caswell Grave	R. P. Bigelow—5 years
1921.	Charles A. Kofoid	Aaron T. Treadwell	L. J. Cole—4 years
1922.	H. H. Wilder	Bennet M. Allen	H. V. Wilson—5 years
1923.	M. F. Guyer	Robert A. Budington	M. M. Metcalf—5 years
1924.	R. G. Harrison	R. K. Nabours	George Lefevre—5 years
1925.	C. R. Stockard	C. R. Moore	C. M. Child—5 years
1926.	S. O. Mast	W. C. Allee	G. A. Drew—5 years
1927.	S. J. Holmes	Robert Chambers, Jr.	C. A. Kofoid—5 years
1928.	Caswell Grave	M. H. Jacobs	H. H. Wilder—5 years
1929.	C. B. Davenport	Fernandus Payne	J. H. Gerould—1 year
1930.	H. V. Neal	E. E. Just	M. F. Guyer—5 years
1931.	Fernandus Payne	D. E. Minnich	R. G. Harrison—5 years
1932.	W. C. Curtis	L. V. Heilbrunn	C. R. Stockard—5 years
1933.	Charles Zeleny	J. H. Bodine	S. O. Mast—5 years
1934.	A. H. Sturtevant	H. W. Rand	S. J. Holmes—5 years
			Caswell Grave—5 years
			C. B. Davenport—4 years

Secretary-Treasurer

1914–1918.	Caswell Grave	1918–1921.	W. C. Allee

Secretary		*Treasurer*	
1921–1924.	W. C. Allee	1922.	D. H. Tennent
1925–1928.	D. E. Minnich	1923–1924.	R. H. Bowen
1928–1929.	L. B. Arey	1925–1930.	L. B. Arey
1929–1930.	D. E. Minnich	1930–1933.	A. B. Dawson
1930–1933.	W. H. Cole		

Representative in the Division of Biology and Agriculture, National Research Council

M. F. Guyer 1919–1921	H. S. Jennings 1922–1925	E. G. Conklin 1923–1926
William Patten 1921–1924	L. L. Woodruff 1925–1928	H. S. Jennings 1929–1931
J. T. Patterson 1924–1927	E. G. Conklin 1926–1929	L. C. Dunn 1931–1932
G. H. Parker 1926–1929	F. R. Lillie 1919–1923	J. H. Bodine 1932–1935
G. H. Parker 1919–1922		

Associate Editors of the Journal of Morphology

1921.	Gary N. Calkins	J. S. Kingsley	William Patten
1921–1922.	E. G. Conklin	M. F. Guyer	W. M. Wheeler
1921–1923.	C. A. Kofoid	F. R. Lillie	J. T. Patterson
1922–1924.	G. A. Drew	H. V. Neal	L. L. Woodruff
1923–1925.	Caswell Grave	D. H. Tennent	H. V. Wilson
1924–1926.	Helen Dean King	S. O. Mast	A. A. Schaeffer
1925–1927.	R. W. Hegner	Fernandus Payne	H. B. Ward
1926–1928.	L. J. Cole	J. H. Gerould	M. H. Jacobs
1927–1929.	W. C. Curtis	J. Percy Moore	A. F. Shull
1928–1930.	Edgar Allen	G. A. Baitsell	R. E. Coker
1929–1931.	S. R. Detwiler	R. S. Lillie	H. J. Muller
1930–1932.	W. R. Coe	E. N. Harvey	H. E. Jordan
1931–1933.	L. V. Heilbrunn	S. O. Mast	G. K. Noble
1932–1934.	D. E. Minnich	B. H. Willier	L. L. Woodruff

LIST OF PLACES OF MEETING

American Morphological Society

1890—Boston
1891—Philadelphia
1892—Princeton
1893—New Haven
1894—Baltimore
1895—Philadelphia
1896—Boston
1897—Ithaca
1898—New York
1899—New Haven
1900—Baltimore
1901—Chicago
1902—Washington

Central Naturalists

1899—Chicago
1900—Chicago

Society of American Zoölogists

1901—Chicago
1902—Washington

American Society of Zoölogists

EASTERN BRANCH

1903—Philadelphia
1904—Philadelphia
1906—New York
1907—New Haven
1909—Boston
1910—Ithaca

JOINT MEETINGS

1905—Ann Arbor
1908—Baltimore
1911—Princeton
1912—Cleveland
1913—Philadelphia

CENTRAL BRANCH

1903—St. Louis
1905—(Mch.) Chicago
1907—(Mch.) Madison
1907—Chicago
1910—(Apr.) Iowa City
1910—Minneapolis
1912—(Apr.) Urbana

MEETING PLACES

1914—Philadelphia
1915—Columbus
1916—New York
1917—Minneapolis
1918—Baltimore
1919—St. Louis
1920—Chicago
1921—Toronto
1922—Boston
1923—Cincinnati
1924—Washington
1925—New Haven
1926—Philadelphia
1927—Nashville
1928—New York
1929—Des Moines
1930—Cleveland
1931—New Orleans
1932—Atlantic City
1933—Boston
1934—Pittsburgh

PROGRAM FOR THE THIRTY-THIRD ANNUAL MEETING OF THE AMERICAN SOCIETY OF ZOÖLOGISTS

PRINCETON UNIVERSITY, PRINCETON, NEW JERSEY
DECEMBER 30, 31, 1935; JANUARY 1, 1936

The Society this year meets jointly with a regional meeting of the Genetics Society of America. On Monday afternoon both societies unite in a symposium on The Species Problem in which zoölogical, physiological and genetic aspects of this topic are to be discussed. The practice instituted last year of arranging certain special section meetings on selected fields and with time available for discussion is continued. This year the topics are cellular physiology, endocrinology, animal behavior and embryology. These sessions are an outcome of the report of the committee on future policies of the Society made at the Cambridge meeting of 1933 in which it was stated "The committee favors the division of the Society into appropriate sections each in charge of a vice-president and a secretary with much autonomy." If any groups meeting this year desire to arrange for a similar program next year tentative steps may be taken for this purpose. Expression of opinion in regard to the advisability of such a plan is invited.

It is fortunately possible this year to revert to the usual scheme of holding the biologists' smoker and the annual dinner on different evenings. The president of the Society, Dr. R. W. Hegner will be the speaker at the dinner on the topic "Multum ex Parvo." Both evening functions are open to all biologists attending the joint meetings of the two societies. Arrangements are being made for special visits to the laboratories of the Rockefeller Institute located in Princeton and to The E. B. Morris Biological Farm of The Wistar Institute.

A list of abstracts of papers presented by members or introduced by members of this Society at the meetings of section F of the American Association for the Advancement of Science at St. Louis will be found appended to the usual list of abstracts. These are arranged in the alphabetical order of the authors' names.

Programs of the genetics demonstrations will be provided at Princeton.

A CORRECTION

In the annual announcement of the meeting mailed to members an error was made by reprinting the names of members of the preceding nominating committee. The correct list for the committee proposing officers for election at this annual meeting is Frank E. Lutz, W. C. Curtis, L. V. Heilbrunn.

TRANSPORTATION ARRANGEMENTS

This spring, transportation arrangements with the railroads were arranged on the usual certificate basis. Recently, however, railroads have instituted a plan of Christmas and New Year holiday reduced rates so that in many parts of the country round trip tickets may be purchased at the rate of a fare and a third. (In New England reductions may be less.) Members of the Society are therefore advised to obtain if possible the round trip fare and a third ticket reading to *Princeton;* otherwise buy the full fare ticket and obtain the certificate for the American Society of Zoölogists and Genetics Society of America. Members are also advised to consult their local ticket agents in regard to dates for purchase of tickets and duration of the period at which special rates are valid. *Both certificates and return parts of round trip tickets to Princeton should be presented at the registration desk at Princeton, as both may be counted in obtaining the 100 necessary for the certificate plan* (*for members unable otherwise to obtain the fare and a third rate*). *Round trip tickets to other points than Princeton cannot be counted.*

PROGRAM

Monday, December 30th

10.00 A.M. *Sect. a.* Embryology. Papers 1 to 12 Room 201 Eno Hall.
Sect. b. Endocrinology. Papers 47 to 56. Room 220 Guyot Hall.
Sect. c. General physiology and evolution. Papers 69 to 75; 145 to 147. Room 307 Guyot Hall.
Sect. d. Cellular physiology. Papers 63 to 68. Room 10 Guyot Hall.
Genetics Society. Demonstration papers. Rooms 226 and 227 Guyot Hall.

12.30–1.30 P.M. Biologists' Luncheon. Campus Club.

2.00 P.M. Joint Symposium with the Genetics Society of America on The Species Problem. Room 10 Guyot Hall. Dr. E. G. Conklin, Princeton University, presiding.

1. Species studies and the species problem. W. H. Longley, Goucher College.
2. The distribution of physiological and chemical peculiarities in the 'natural' groups of organisms. A. C. Redfield, Harvard University.
3. Interspecific sterility. Curt Stern, University of Rochester.
4. Genetic aspects of certain problems of evolution. E. M. East, Harvard University.

8.00 P.M. Biologists' Smoker, Procter Hall, The Graduate College.

Tuesday, December 31st

9.00 A.M. *Sect. a.* Embryology. Papers 13 to 22. Room 10 Guyot Hall.
Sect. b. Endocrinology. Discussion lead by Dr. F. L. Hisaw. Papers 57 to 62. Room 201 Eno Hall.
Sect. c. General physiology. Papers 76 to 84. Room 307 Guyot Hall.
Sect. d. Histology and Cytology. Papers 148 to 159. Room 220 Guyot Hall.

10.00 A.M. *Genetics Society.* Demonstration papers. Rooms 226 and 227 Guyot Hall.

12.00 M. Annual business meeting of the American Society of Zoölogists. Room 10 Guyot Hall.

12.30–1.30 P.M. Biologists' Luncheon. Campus Club.

2.00 P.M. Demonstrations. Papers 28 to 34, 99 to 108, 160 to 163, 174. Rooms 101 and 102 Guyot Hall. (Other rooms may be announced.)

4.00 P.M. Visit to laboratories of the Rockefeller Institute. (Inquire for details at information desk.)

8.00 P.M. Zoölogists' Dinner. Address by President Robert W. Hegner of the American Society of Zoölogists on 'Multum ex Parvo.' Procter Hall, The Graduate College.

WEDNESDAY, JANUARY 1ST

9.00 A.M. *Sect. a.* Embryology. Discussion lead by Dr. B. H. Willier. Papers 23 to 27. Room 10 Guyot Hall.

Sect. b. Animal reactions to light. Discussion lead by Dr. S. O. Mast. Papers 93 to 98. 201 Eno Hall.

Sect. c. General physiology. Papers 85 to 92. 307 Guyot Hall.

Sect. d. Protozoology, morphology and miscellaneous. Papers 169 to 173, 187A, 187 to 189. Room 220 Guyot Hall.

10.00 A.M. *Genetics Society.* Demonstration papers. Rooms 226 and 227 Guyot Hall.

1.00 P.M. Visit to The Wistar Institute Farm. (Inquire for details at information desk.)

LIST OF TITLES

EMBRYOLOGY

Read

Monday morning, December 30th. Room 201 Eno Hall

1. Cardiac inversion and translocation in a newborn calf. Charles D. Howell and W. Gardner Lynn, Johns Hopkins University. (Lantern; 10 min.)
2. The susceptibility of the gonads of Oryzias latipes to x-radiation, and recovery after treatment. Archie N. Solberg, Columbia University. (Introduced by L. G. Barth.) (Lantern; 10 min.)
3. The effects of x-radiation on the regeneration of the hydroid, Pennaria tiarella. William O. Puckett, Princeton University. (Introduced by C. F. W. McClure.) (Lantern; 15 min.)
4. Individually specific blood inhibition of fertilization as an explanation of self sterility in the tunicate Styela. H. H. Plough, Amherst College. (Lantern; 10 min.)
5. Changes at the surface of Arbacia punctulata eggs prior to membrane elevation. Floyd Moser, University of Pennsylvania. (Introduced by L. V. Heilbrunn.) (Lantern; 15 min.)
6. Nuclear increase during development as a factor in differentiation and in heredity. E. E. Just, Howard University. (10 min.)
7. On the effect of lithium chloride on cleavage and antipolar lobe formation in Sabellaria. G. B. Moment, Goucher College. (Lantern; 5 min.)
8. Definitive localization in Fundulus. Jane M. Oppenheimer, Yale University. (Introduced by W. R. Coe.) (Lantern; 15 min.)
9. A study of induction in the chick blastoderm, with special reference to the behavior of the epiblast. Gilbert L. Woodside, Harvard University. (Introduced by Leigh Hoadley.) (Lantern; 8 min.)
10. Auxin from chick embryos. True W. Robinson and Gilbert L. Woodside, Harvard University. (Introduced by Leigh Hoadley.) (Lantern; 7 min.)
11. The relation of the lymphoid tissue of avian bone marrow to erythrocyte production. H. E. Jordan, University of Virginia. (Lantern; 15 min.)
12. Early stages of calcification in the rat embryo. E. Alfred Wolf and Thomas F. McBride, University of Pittsburgh. (Lantern; 10 min.)

Tuesday morning, December 31st. Room 10 Guyot Hall

13. On the development of thyrotropic function in the hypophysis of the tadpole. William Etkin, College of the City of New York and American Museum of Natural History. (Lantern; 12 min.)
14. The development of limbs in frog larvae subjected to salts of various metals. A. Emerson Warren, McMaster University. (Introduced by A. B. Dawson.) (Lantern; 7 min.)

15. The continuity of the germ cells in the urodele, Plethodon cinereus (Green). J. Wendell Burger, Princeton University. (Introduced by E. G. Butler.) (Lantern; 15 min.)
16. Micro-moving pictures of ovulation and egg transport in the frog. Roberts Rugh, Columbia University and Hunter College. (Cinema; 15 min.)
17. Complete and reduplicated shoulder girdles and associated muscles resulting from transplantation in the urodele embryo. Isabel H. Blount, University of Minnesota. (Introduced by A. R. Ringoen.) (Lantern; 15 min.)
18. Correlated genetic and embryological experiments on Triturus. I. Hybridization; development of three species of Triturus and their hybrid combinations. Victor C. Twitty, Stanford University. (Introduced by C. H. Danforth.) (Lantern; 8 min.)
19. Correlated genetic and embryological experiments on Triturus. II. The embryological basis of species differences in pigment pattern. Victor C. Twitty, Stanford University. (Introduced by C. H. Danforth.) (Lantern; 7 min.)
20. Transplantation experiments on the hind limb of Amblystoma tigrinum. Walter Alva Stultz, University of Georgia School of Medicine and Yale University. (Introduced by A. Petrunkevitch.) (Lantern; 10 min.)
21. Factors concerned in the development of the ear in Amblystoma punctatum. Ross G. Harrison, Yale University. (Lantern; 15 min.)
22. The totipotency of regenerates in urodeles tested by some new methods. O. E. Schotté, Amherst College. (Lantern; 15 min.)

Wednesday morning, January 1st. Beginning at 9.00. Room 10 Guyot Hall

Discussion lead by B. H. Willier

23. The effect of hydrogen ions in regulating the intensity of mutual inductions and in inducing polarity in Fucus eggs. D. M. Whitaker, Stanford University. (Introduced by C. V. Taylor.) (Lantern; 15 min.)
24. Determination of limb axes. F. H. Swett, Duke University School of Medicine. (Introduced by B. H. Willier.) (Lantern; 15 min.)
25. Early developmental phenomena in the macaque and their significance in primate embryology. George L. Streeter, Carnegie Institution of Washington. (Lantern; 15 min.)
26. The development of the rat egg in altered surroundings. John S. Nicholas, Yale University. (Lantern; 15 min.)
27. Zenoplastic experiments on amphibians. Johann Holtfreter. (Introduced by the Secretary.) (Lantern; 15 min.)

By demonstration

Tuesday afternoon, December 31st. Beginning at 2.00. Room 101 and 102 Guyot Hall

28. Early stages in the development of the swimbladder in Hemichromis bimaculata Robert S. McEwen, Oberlin College.
29. Chromosome numbers in androgenetic embryos of Triturus viridescens. G. Fankhauser and C. T. Kaylor, Princeton University.

30. Experiments on androgenesis in Triturus viridescens. Cornelius T. Kaylor, Princeton University. (Introduced by G. Fankhauser.)
31. Life histories of three species of California Triturus, including two new species. Victor C. Twitty, Stanford University. (Introduced by C. H. Danforth.)
32. Development of hybrids in various combinations. Victor C. Twitty, Stanford University. (Introduced by C. H. Danforth.)
33. Devices for experiments on amphibian embryos. Walter Alva Stultz, Yale University and University of Georgia School of Medicine. (Introduced by A. Petrunkevitch.)
34. Early stages of calcification of bones in vertebrates. E. Alfred Wolf, Thomas F. McBride and Harry J. Lipman, University of Pittsburgh.

By title

35. The germinal vesicle of the egg of Sabellaria vulgaris, a polychaete annelid. A. J. Waterman, Williams College.
36. Tissue specificity in development. A. J. Waterman, Williams College.
37. Embryology and histology of the anal fin of Platypoecilus maculatus. Leonard Grumbach, Cornell University.
38. Prospect and potency in a urodele blastula subjected to a transverse thermal differential. Francis G. Gilchrist, Pomona College.
39. A histological study of larval transplants to the adult newt, Triturus viridescens viridescens. Henry Idzkowsky, University of Pittsburgh. (Introduced by H. H. Collins.)
40. Effects of lack of iodine upon amphibian growth and metamorphosis. W. Gardner Lynn and Charles Brambel, Johns Hopkins University.
41. Cholesterol content and iodine deficiency in developing tadpoles. Charles E. Brambel and W. Gardner Lynn, Johns Hopkins University.
42. Observations on the anuran pancreas during metamorphosis. R. G. Janes, New York University. (Introduced by O. M. Helff.)
43. Observations on the development of some anura. Karl A. Youngstrom, University of Kansas. (Introduced by H. B. Latimer.)
44. The origin of the notochord in Alligator mississippiensis. A. M. Reese, West Virginia University.
45. The ossification of the chick skeleton. I. The wing and leg. Carl J. Sandstrom, New York University.
46. Heteroplastic transplantation of embryonic duck kidney tissue to the just-hatched chick. Carl J. Sandstrom, New York University.

ENDOCRINOLOGY

Read

Monday morning, December 30th. Beginning at 10.00. Room 220 Guyot Hall

47. The altered thyroid glands of urodele larvae developing with additional embryonic pituitary transplants. Raymond F. Blount, University of Minnesota. (Introduced by D. E. Minnich.) (Lantern; 15 min.)
48. The thyroid glands of hypophysectomized newts after treatment with anterior pituitary, thyroid and iodine. A. Elizabeth Adams and Beatrice Gray, Mount Holyoke College. (Lantern; 6 min.)

49. The response of thyroids of hypophysectomized newts to injections of phyone and their reaction after cessation of treatment. A. Elizabeth Adams and Florence Martindale, Mount Holyoke College. (Lantern; 9 min.)
50. The effect of adrenalectomy on blood cholesterol. E. W. Blanchard, Bryn Mawr College and Cold Spring Harbor Biological Laboratory. (Lantern; 10 min.)
51. The use of vagina and uterine grafts to demonstrate the endocrine function of ovarian grafts in males. Carroll A. Pfeiffer, New York Hospital and Cornell University Medical College. (Introduced by C. V. Morrill.) (Lantern; 10 min.)
52. Synergistic action of pregnancy urine and pregnant mare serum extracts on young guinea pig ovaries. S. L. Leonard and O. L. Leonard, Union College. (Introduced by James W. Mavor.) (Lantern; 15 min.)
53. Graafian follicle growth and oestrus in the guinea pig. Hugh I. Myers, William C. Young and Edward W. Dempsey, Brown University. (Lantern; 15 min.)
54. Gonad hormone effects in normal, spayed, and hypophysectomized rats. Warren O. Nelson, Yale University. (Lantern; 15 min.)
55. The effect of hebin upon the reproductive system of the chick embryo. L. V. Domm and E. A. Dennis, The University of Chicago. (Lantern; 15 min.)
56. Spontaneous sterility in the male rat. George K. Smelser, Columbia University. (Lantern; 15 min.)

Tuesday morning, December 31st. Beginning at 9.00. Room 201 Eno Hall

Discussion lead by F. L. Hisaw

57. Effects of simultaneous oestrin-corporin treatment on the uterus, cervix, vagina and sex skin of castrated monkeys. Frederick L. Hisaw, Harvard University. (Lantern; 15 min.)
58. Influence of estrogenic hormones on the pelvis of the mouse. W. U. Gardner, Yale University School of Medicine. (Introduced by Edgar Allen.) (Lantern and cinema; 15 min.)
59. Ovulation. Edgar Allen, R. T. Hill and H. S. Burr, Yale University School of Medicine. (Lantern and cinema; 15 min.)
60. Effects of follicle stimulating and luteinizing hormones on the testicles and accessories of normal and hypophysectomized rats. Roy O. Greep, Harvard University. (Lantern; 15 min.)
61. The effect of fractionated and unfractionated gonadotropic preparations on testes and comb growth in the chick. W. R. Breneman, Miami University. (Lantern; 15 min.)
62. Augmentation of the gonad stimulating action of pituitary extracts by yeast extracts and by copper salts. H. L. Fevold, Harvard University. (Introduced by Alfred C. Redfield.) (Lantern; 15 min.)

CELLULAR PHYSIOLOGY

Monday morning, December 30th. Beginning at 10.00. Room 10 Guyot Hall
Discussion led by Robert Chambers

63. Cleavage of non-nucleated fragments of Arbacia eggs. Ethel B. Harvey, Princeton University. (15 min.)
64. Localization of peptidase activity in marine eggs. Heinz Holter, Washington Square College, New York University. (Introduced by Ruth B. Howland.) (Lantern; 15 min.)
65. The relation between the sperm-aster and the first-cleavage figure in Arbacia eggs. Henry J. Fry, Cornell University Medical College. (Lantern; 15 min.)
66. Oxygen uptake of cell fragments obtained by centrifuging the egg of the sea urchin, Arbacia punctulata. Herbert Shapiro, Princeton University. (Introduced by E. Newton Harvey.) (Lantern; 10 min.)
67. Nuclear movements in the developing Drosophila egg. Alfred F. Huettner, Washington Square College, New York University. (Lantern; 15 min.)
68. A physical property of the plasma membrane. Robert Chambers, Washington Square College, New York University. (Cinema; 10 min.)

COMPARATIVE AND GENERAL PHYSIOLOGY

Read

Monday morning, December 30th. Beginning at 10.00. Room 307 Guyot Hall

69. Effects of various periods of starvation on growth, reproduction, and longevity in Cladocera. Lester Ingle, Brown University. (Introduced by A. M. Banta.) (Lantern; 15 min.)
70. Osmotic exchanges of Phascolosoma. Edward F. Adolph, University of Rochester. (Lantern; 10 min.)
71. The gaseous metabolism and changes in chemical composition of the blow fly, Phormia regina (Meigen), during pupation. F. A. Hitchcock and J. G. Haub, Ohio State University. (Introduced by W. M. Barrows.) (Lantern; 15 min.)
72. The heat production of pupae of Galleria mellonella throughout development. Frederick Crescitelli and Ivon R. Taylor, Brown University. (Lantern; 15 min.)
73. The oxygen consumption of Hexagenia recurvata during the winter and early spring. A. H. Morgan and J. F. Wilder, Mount Holyoke College. (Lantern; 12 min.)
74. Quantitative studies on the respiration of arthropods and on the permeability of their outer integument to gases, water and electrolytes. N. S. Royston Maloeuf, Cornell University. (Introduced by H. D. Reed.) (10 min.)
75. Hemoglobin function in the developing chick. F. G. Hall, Duke University. (Lantern; 12 min.)

Tuesday morning, December 31st. Beginning at 9.00. Room 307 Guyot Hall

76. The influence of visible light on reorganization and regeneration in the polychaete Sabella. John Berrill, McGill University. (Introduced by E. G. Conklin.) (Lantern; 15 min.)
77. Development of a secondary sexual character in the Crustacea. Hugh H. Darby, College of Physicians and Surgeons, Columbia University. (Lantern; 15 min.)
78. Further studies on the biological action of intense sonic vibration. Leslie A. Chambers, University of Pennsylvania. (Lantern; 15 min.)
79. Lethal periods for Paramecium in normal and polarized light of high intensity. Robert C. Miller and Vance Tartar, University of Washington. (Lantern; 10 min.)
80. The effect of x-rays on cleavage in Arbacia eggs: Evidence of nuclear control of division rate. Paul S. Henshaw, Memorial Hospital, New York City. (Lantern; 15 min.)
81. The effect of sulfur on the rate of respiration in Chilomonas paramecium. S. O. Mast, D. M. Pace and Louise R. Mast, Johns Hopkins University. (Lantern; 15 min.)
82. Animal and plant cells in mixed cultures. Ralph Buchsbaum The University of Chicago. (Introduced by Sewall Wright.) (Lantern; 15 min.)
83. Periodicity and diurnal rhythm in the firefly, Photinus pyralis. John B. Buck, Johns Hopkins University. (Introduced by S. O. Mast.) (Lantern; 15 min.)
84. A comparison of maze behavior in paired and isolated shell-parrakeets (Melopsittacus undulatus Shaw) in a two-alley problem box. W. C. Allee and R. H. Masure, The University of Chicago. (Lantern; 15 min.)

Wednesday morning, January 1st. Beginning at 9.00. Room 307 Guyot Hall

85. The manipulation of Hydra's nematocysts by Microstomum. Wm. A. Kepner, W. C. Gregory and R. J. Porter, University of Virginia. (Lantern; opaque projection; 15 min.)
86. Water filtration by the oyster and a new hormone effect thereon. T. C. Nelson, Rutgers University. (Lantern; 15 min.)
87. The growth of the mussel, Mytilus edulis, at Woods Hole, Massachusetts. II. Oscar W. Richards, Yale University. (Lantern; 15 min.)
88. The combined effects of heavy water and temperature on the heart rate. T. Cunliffe Barnes and J. Warren, Yale University. (Lantern; 10 min.)
89. The non-glomerular origin of urine after sublimate poisoning of the tubules of the perfused frog kidney. Rudolf Theodore Kempton, University of Pennsylvania and Princeton University. (Introduced by Arthur K. Parpart.) (Lantern; 10 min.)
90. Alcoholic solutions as gastric secretogogues. E. E. Just, Howard University. (5 min.)
91. Studies on hair growth in the immature white rat. Earl O. Butcher, Hamilton College. (Lantern; 15 min.)
92. Circular and spiral drift in cutaneous tactile fields. A. A. Schaeffer, Temple University. (Lantern; 15 min.)

ANIMAL RESPONSES TO LIGHT

Wednesday morning, January 1st. Beginning at 9.00. Room 201 Eno Hall
Discussion lead by S. O. Mast

93. Modifiability of motor responses to light in lower animals. Manton Copeland, Bowdoin College. (Lantern; 15 min.)
94. Dark adaptation in organisms. William L. Dolley, Jr., University of Buffalo. (Lantern; 15 min.)
95. Structural and functional factors determining visual motor responses of the fiddler crab. Leonard B. Clark Union College. (Lantern, cinema; 15 min.)
96. Light intensity and the locomotor response. John H. Welsh, Harvard University. (Lantern; 15 min.)
97. Nervous responses to illumination in invertebrates. C. Ladd Prosser, Clark University. (Lantern; 15 min.)
98. Photoreceptors of lower animals. Walter N. Hess, Hamilton College. (Lantern; 15 min.)

By demonstration

Rooms 101 and 102, Guyot Hall

99. The manipulation of Hydra's nematocytes by Microstomum. Wm. A. Kepner, W. C. Gregory and R. J. Porter, University of Virginia.
100. A method for the measurement of the heat production of small organisms. Ivon R. Taylor and Frederick Crescitelli, Brown University.
101. Retinal changes in the catfish occurring under constant external conditions. John H. Welsh and C. M. Osborn, Harvard University.
102. The non-cellular space in tissues. Arthur K. Parpart, Princeton University.
103. Hyperactivity of the pars intermedia as a graft in the tadpole. William Etkin, College of the City of New York and American Museum of Natural History.
104. The hormonal control of secondary sex characters in finches. Emil Witschi, State University of Iowa.
105. Histology and physiology of urinary elimination of vitamin C. A. Giroud and C. P. Leblond, Faculty of Medicine, Paris. (Introduced by Edgar Allen.)
106. Spontaneous sterility in the male rat. George K. Smelser, Columbia University.
107. A second method of contraction in vertebrate striated muscle. Ulrich Dahlgren, Princeton University.
108. An internal character in the Cyrtacanthacrinae (Orthoptera, Acrididae) of possible taxonomic value. Eleanor H. Slifer and Robert L. King, State University of Iowa.

By title

109. Methods of reproduction other than binnary fission in certain species of free-living amoebae. Redginal Hewitt, Syracuse University. (Introduced by V. F. Lindeman.)

110. The effects of salts on reversal in ciliary action in Paramecium multimicronucleatum. Joseph F. Oliphant, Johns Hopkins University. (Introduced by S. O. Mast.)
111. The effect of silicon on growth and respiration in Chilomonas paramecium. S. O. Mast and D. M. Pace, Johns Hopkins University.
112. Regeneration and growth in Planaria maculata under the influence of endocrine feeding. E. D. Goldsmith, Washington Square College, New York University. (Introduced by Harry A. Charipper.)
113. The eyeless cave flatworm, Spalloplana percaeca. J. Williams Buchanan, Northwestern University.
114. Peristalsis and physico-chemical differences along the longitudinal axis of the earthworm. N. S. Royston Maloeuf, Cornell University. (Introduced by H. D. Reed.)
115. Fragmentation in the naid Nais paraguayensis Mich. 1905. Libbie H. Hyman, American Museum of Natural History.
116. Action of salts on the heart of the oyster. Edward Walzl, Johns Hopkins University. (Introduced by S. O. Mast.)
117. Influence of external stimuli in changing the sexual phase in mollusks of the genus Crepidula. W. R. Coe, Yale University.
118. Sequence of sexual phases in Teredo, Ostrea and Crepidula. W. R. Coe, Yale University.
119. The action of cupric chloride on the viscosity of Arbacia egg protoplasm. C. A. Angerer, University of Pennsylvania.
120. The influence of temperature upon the respiratory regulation of an amphipod crustacean (Grammarus fasciatus). Verlus F. Lindeman, Syracuse University.
121. Studies in population physiology. V. the oxygen consumption of the flour beetle, Tribolium confusum Duval. Thomas Park, Johns Hopkins University.
122. Studies in population physiology. VI. The effect of graded condition flour on the fecundity and fertility of Tribolium confusum Duval. Thomas Park, Johns Hopkins University.
123. The water content of Chortophaga viridifasciata nymphs and adults starved at different relative humidities. Daniel Ludwig, New York University.
124. Relation between vitamins and the growth and survival of goldfishes in homotypically conditioned water. Gertrude Evans, The University of Chicago. (Introduced by W. C. Allee.)
125. The effect of intermittent light on the adaptation time of retinal pigment. L. B. Arey and R. G. Price, Northwestern University Medical School.
126. Sexual selection in fishes. G. K. Noble and Brian Curtis, American Museum of Natural History.
127. Effect of 2.4 dinitrophenol on the bioelectric potentials of frog skin. H. F. Rosene, University of Texas. (Introduced by E. J. Lund.)
128. Functioning hypophyseal transplants in Amphibia. Wayne J. Atwell, University of Buffalo.
129. The urodele pancreas and liver in hypo- and hyperpituitarism. A. Elizabeth Adams and Elsie N. Ward, Mount Holyoke College.
130. Seasonal and temperature-induced changes in the thyroid of Bufo valliceps. A. H. Morgan and Mirian Stokes, Mount Holyoke College.

131. The effects of natural and experimental low temperatures on the thyroids of Rana pipiens and Triturus viridescens. A. H. Morgan and Elizabeth K. Moyer, Mount Holyoke College.
132. Studies of islet and acinar tissue variations in the pancreas of the rat. Walter N. Hess and Clinton W. Root, Hamilton College.
133. Autolysis of anuran tail muscle in vitro. F. W. Dunihue, New York University. (Introduced by O. M. Helff.)
134. The sensory mechanisms involved in the migration of newly-hatched fresh water turtles. G. K. Noble and A. Braslovsky, American Museum of Natural History.
135. The effects of ovariotomy and hypophysectomy on parturition in snakes. H. J. Clausen, American Museum of Natural History.
136. Asymmetry in the feather of the guinea fowl. Mary Hardesty, Tulane University.
137. Rate of locomotion and dark adaptation in Dineutes nigroir (Roberts). Willard J. Trezise, Johns Hopkins University. (Introduced by S. O. Mast.)
138. The avenue of reception of sexually stimulating light in ferrets. T. Hume Bissonnette, Trinity College.
139. Modification of serum precipitin reactions by method of injection. Harold R. Wolfe, University of Wisconsin.
140. The effect of thyroidectomy on the gonad-stimulating hormone of the anterior pituitary in immature male rats. Kathryn F. Stein and Margaret Lisle, Mount Holyoke College. (Introduced by A. Elizabeth Adams.)
141. The behavior of the red cell count of guinea pigs following exposure to low pressures. William Kleinberg and Albert S. Gordon, Washington Square College, New York University. (Introduced by Harry A. Charipper.)
142. Changes in the red blood cell picture of the rabbit during the development of a tolerance to cyanide. Albert S. Gordon, Washington Square College, New York University. (Introduced by Harry A. Charipper.)
143. The use of low pressures in the study of the erythrolytopoietic relations of the guinea pig's spleen. Albert S. Gordon and William Kleinberg, Washington Square College, New York University. (Introduced by Harry A. Charipper.)
144. The reduction of methylene blue in nerve cells. Elbert C. Cole, Williams College.

EVOLUTION

Read

Monday morning, December 30th. Room 307 Guyot Hall

145. Can artificial selection produce unlimited change? H. D. Goodale, Mount Hope Farm. (Charts; 15 min.)
146. Genetics and animal relationship. Alan Boyden, Rutgers University. (Lantern; 15 min.)
147. A naturalistic definition of life. F. H. Pike, Columbia University. (10 min.)

CYTOLOGY

Read

Tuesday morning December 31st. Beginning at 9.00. Room 220 Guyot Hall

148. Cytology of the white body of Loligo. Hope Hibbard, Oberlin College. (Lantern; 10 min.)
149. The lateral-line organs in the terrestrial red-eft stage of the newt, Triturus viridescens. Alden B. Dawson, Harvard University. (Lantern; 8 min.)
150. Studies by means of tissue transplants on the color patterns of tropical marine fish. H. B. Goodrich, Wesleyan University. (Lantern; 10 min.)
151. A study of the megakaryocyte and blood platelet in the rat. Christianna Smith and Jean Hastings. Mount Holyoke College. (Lantern; 10 min.)
152. The use of trypan blue in detecting cell death in the perfusion of the mammalian kidney and the evaluation of some modified Ringer-Locke fluids by this method. J. M. Darlington, Brown University and Scranton-Keystone Junior College. (Introduced by A. D. Mead.) (Lantern; 10 min.)
153. Abnormal nuclear phenomena in 3 weeks' kittens' ovaries. Elizabeth Sneider, Brown University. (Introduced by A. D. Mead.) (Lantern; 10 min.)
154. The cytology of the hypophysis cerebri of the bat, Myotis lucifugus lucifugus. Elizabeth L. Sawyer, University of Missouri. (Introduced by Mary J. Guthrie.) (Lantern, charts; 15 min.)
155. The cytology and function of hepatic cells of the chick embryo in chorio-allantoic grafts. Albert J. Dalton, Western Reserve University. (Lantern; 15 min.)
156. The chromoplast of orthopteran germ cells. H. Irene Corey, University of Pennsylvania. (Introduced by C. E. McClung.) (Lantern; 15 min.)
157. Organization of dipteran salivary gland chromosomes. C. W. Metz, Carnegie Institution of Washington and Johns Hopkins University. (Lantern; 15 min.)
158. A comparative study of chromonemata in Trillium erectum L., Tradescantia reflexa Raf. and Dissosteira carolina L. B. R. Nebel and M. L. Ruttle, New York State Agricultural Experiment Station. (Introduced by F. Schrader.) (Lantern; 15 min.)
159. Cytological observations on the gall wasp Neuroterus lenticularis (Spathegaster baccarum): Hymenoptera. Kenneth S. Dodds, Durham University, Armstrong College England. (Introduced by Fernandus Payne.) (10 min.)

By demonstration

Tuesday afternoon, December 31st. Beginning at 2.00. Rooms 101 and 102 Guyot Hall

160. A comparative study of chromonemata in Trillium erectum L., Tradescantia reflexa Raf. and Dissosteira caroline L. B. R. Nebel and M. L. Ruttle, New York State Agricultural Experiment Station. (Introduced by F. Schrader.)
161. The cellular constituents of the islets of Langerhans of mammals. Thurlo B. Thomas Harvard University. (Introduced by Alden B. Dawson.)

162. A chromosome (tetrad) model for use on the lecture desk in the explanation of segregation (reduction). Manton Copeland, Bowdoin College.
163. Selective staining of nervous and non-nervous tissues with methylene blue, and the making of permanent mounts. Elbert C. Cole, Williams College.

By title

164. The cellular constituents of the islets of Langerhans of mammals. Thurlo B. Thomas, Harvard University. (Introduced by Alden B. Dawson.)
165. The activation of the embryonic thyroid of the chick by means of thyrotropic hormone of the anterior pituitary. Gilbert L. Woodside, Harvard University. (Introduced by Alden B. Dawson.)
166. Crustacean eye-stalk hormone and the migration of the retinal pigments. Louis H. Kleinholz, Harvard University. (Introduced by Alden B. Dawson.)
167. The effect of excess cholesterol on the vacuome in nerve cells of fish. Ross C. MacCardle, Temple University.
168. Histological changes accompanying the growth of the mid-intestine of Japanese beetle larvae. Daniel Ludwig and W. Fulton Abercrombie, New York University.

PROTOZOÖLOGY

Read

Wednesday morning, January 1st. Beginning at 9.00. Room 220 Guyot Hall

169. The occurrence of the avian malarias in nature. Reginal D. Manwell, Syracuse University. (Lantern, charts; 12 min.)
170. Life cycle of Endamoeba blattae (Bütschli, 1878). Samuel Morris, Temple University. (Introduced by D. H. Wenrich.) (Lantern; 15 min.)
171. The relation of endomixis to vitality in Paramecium aurelia. T. M. Sonneborn, Johns Hopkins University. (Introduced by H. S. Jennings.) (Charts; 15 min.)
172. A comparative study of the contents of the gelatinous accumulations of the culture media and the contents of the cytoplasm of Amoeba proteus and Arcella vulgaris. E. DeWitt Miller, University of Virginia. (Introduced by H. E. Jordan.) (Lantern; 10 min.)
173. The behavior in mitosis of the keryosome and so-called peripheral chromatin in Amoeba proteus. H. W. Chalkley, National Institute of Health. (Lantern; 15 min.)

By demonstration

Tuesday afternoon, December 31st. Room 101 or 102 Guyot Hall

174. Chart of taxonomic relationships of free-living amebas. A. A. Schaeffer, Temple University.
174A. (See title 172.)

By title

175. The Folliculinidae (Infusoria heterotricha) of the British Coast. E. Fauré-Fremiet, College de France, Paris.
176. The bean-seed infusion as a culture medium for paramecia. Elbert C. Cole, Williams College.
177. Relation of hydrogen-ion concentration to growth and encystment of Entamoeba histolytica in cultures. Gladys M. Craig, New York University. (Introduced by R. P. Hall.)
178. Effects of alcohol on the growth of flagellates and ciliates in bacteria-free media. J. B. Loefer and R. P. Hall, New York University.
179. Growth characteristics of Paramecium bursaria in bacteria-free cultures. John B. Loefer, New York University. (Introduced by R. P. Hall.)
180. Growth characteristics of the symbiotic alga from Paramecium bursaria. John B. Loefer, New York University. (Introduced by R. P. Hall.)
181. Fermentation of carbohydrates by Glaucoma, and effects of carbohydrates on growth of two species. David F. Johnson, New York University. (Introduced by R. P. Hall.)
182. Isolation and growth of Glaucoma ficaria in bacteria-free cultures. David F. Johnson, New York University. (Introduced by R. P. Hall.)
183. Growth of Glaucoma ficaria in cultures with single species of other microorganisms. David F. Johnson, New York University. (Introduced by R. P. Hall.)
184. Growth of Colpidium in relation to certain incomplete proteins and amino acids. R. P. Hall and A. M. Elliott, New York University.
185. Characterization of species of Colpidium, with special reference to C. campylum and C. striatum. Alfred M. Elliott, State Teachers College, Bemidji, Minnesota. (Introduced by R. P. Hall.)
186. Population fluctuations in cultures of Paramecium. Edgar P. Jones, University of Akron and University of Pittsburgh.

MORPHOLOGY AND MISCELLANEOUS

Read

Wednesday morning, January 1st. Room 220 Guyot Hall

187A. Minimum length of life of the parasitic stage of Strongyloides ratti, as determined by single larva infections. George L. Graham, Rockefeller Institute for Medical Research. (Lantern; 12 min.)
187. Studies on the embryology and anatomy of the reproductive system of Iowa hawks. Allan J. Stanley and Emil Witschi, University of Iowa. (Introduced by P. L. Risley.) (Lantern; 10 min)
188. Abnormalities in flatfishes, Heterosomata. E. W. Gudger, American Museum of Natural History. (Opaque projection; 10 min.)
189. A whale shark off Long Island, the most northerly record. E. W. Gudger, American Museum of Natural History. (Opaque projection; 5 min.)

MORPHOLOGY AND PARASITOLOGY

By title

190. Spherulites as specific characters. E. A. Andrews, Johns Hopkins University.
191. Snails with generic differences in secondary sex organs. E. A. Andrews, Johns Hopkins University.
192. Spermatophores as generic characters. E. A. Andrews, Johns Hopkins University.
193. Regeneration of the anal fin of cyprinodont fishes. Leonard Grumbach, Cornell University. (Introduced by Myron Gordon.)
194. Observations on the musculature of the red-spotted newt. H. D. Porter and H. H. Collins, Washington and Jefferson College and University of Pittsburgh.
195. Transplanted larval hearts in the adult red-spotted newt. W. H. Wright and H. H. Collins, University of Pittsburgh.
196. Growth and differentiation of larval grafts upon the adult red-spotted newt. W. H. Wright and H. H. Collins, University of Pittsburgh.
197. Further studies of the 'ovate bodies' and structure of the hair of the fossil ground sloth (Nothrotherium shastense). Leon Augustus Hausman, New Jersey College for Women, Rutgers University.
198. Measurements of the skull and of some of the long bones of the skunk (Mephitis mesomelas avia). Homer B. Latimer, University of Kansas.
199. The American species of the genus Stenostomum. John W. Nuttycombe and Aubrey J. Waters, University of Georgia.
200. Observations on the prenatal transmission of Trichinella spiralis. Fred J. Holl and Nicholas I. Valvo, University of Buffalo.

ECOLOGY

By title

201. The diurnal, vertical distribution of a chlorophyll-bearing organism belonging to the genus Phacus. R. P. Cowles and Charles Brambel, Johns Hopkins University.
202. Some physical and chemical conditions found in a bog-pond. Charles E. Brambel and R. P. Cowles, Johns Hopkins University.
203. On the spiders of Barro Colorado Island, Panama Canal Zone. A. M. Chickering, Albion College.
204. An experimental study of predatory action in flour beetle populations. Royal N. Chapman and Bertha Hanaoka, University of Hawaii.
205. Studies in nocturnal ecology. VI. Further investigation of activity of Passalus cornutus and description of new recording apparatus. Orlando Park, Northwestern University.
206. The physical limitations of Centrarchid nest construction. C. M. Breder, Jr., New York Aquarium.
207. Selection of nesting sites with intraspecific and extraspecific interactions in nesting Centrarchidae. C. M. Breder, Jr., New York Aquarium.
208. A technique for the quantitative measure of tropisms and social behavior in active animals, with an illustration. C. M. Breder, Jr., and R. F. Nigrelli, New York Aquarium and New York University.
209. Post-asymptotic studies in populations of Lebistes. C. M. Breder, Jr., and C. W. Coates, New York Aquarium.

A list of abstracts of papers presented by members or introduced by members of the Society at the meetings of Section F of the American Association for the Advancement of Science at St. Louis will be found appended to the usual list of abstracts. These are arranged in the alphabetical order of the authors' names.

ABSTRACTS

An author index for all abstracts will be found on pages 141 to 146.

EMBRYOLOGY

Read

1. CARDIAC INVERSION AND TRANSLOCATION IN A NEWBORN CALF. Charles D. Howell and W. Gardner Lynn, John Hopkins University. (Lantern; 10 min.)

The calf's heart lay in the middle of the neck with its normal antero-posterior and dorso-ventral axes reversed. The aorta proceeded directly posteriorly from the dorsal side of the heart, thus lacking the arch and ascending and descending divisions. There was no common brachiocephalic or bicarotid artery. Two precaval veins opened symmetrically on either side of the postcava. The hemiazygos vein entered the left precava, the coronary sinus being absent.

This condition probably originated at an early stage (compare 4 to 5 mm. pig) possibly through pressure of an anteriorly displaced umbilical stalk which forced the ventricles anterior to the auricles and prevented the formation of a normal cardiac loop. In this position the heart could not migrate with growth of the embryo, and would thus remain permanently in the neck.

It is possible that the position of the beating heart inhibited the formation of the anterior cardinal anastomosis. Thus the left anterior and left common cardinal veins remained functional in their primitive positions. The latter then became the left precava instead of forming the coronary sinus and the hemiazygos retained its connection to this new derivative of the common cardinal. Convenience of attachment seems to account for the failure of the left subclavian to join the brachiocephalic artery. The absence of the bicarotid trunk may have resulted from the fact that the aortic sac lacked the stimulus to elongate which may normally be supplied by posterior cardiac migration as well as by inherent factors.

2. THE SUSCEPTIBILITY OF THE GONADS OF ORYZIAS LATIPES TO X-RADIATION, AND RECOVERY AFTER TREATMENT. Archie N. Solberg, Columbia University. (Introduced by L. G. Barth.) (Lantern; 10 min.)

The purpose of this investigation was to determine the relative susceptibility to x-radiation of the gonads of both sexes of the fish, Oryzias latipes, and the time for recovery. The ability of the germ cells to produce normal embryos has been used as a test for injury.

Adult Oryzias have been induced to breed daily, a single female averaging about twenty eggs per day. After a 10-day breeding and viability test of each pair, selected individuals were x-rayed and the eggs produced thereafter collected each morning. Embryos were allowed to develop for 4 days and were then examined for abnormalities. Four dosages have been used: 1980, 1485, 990 and 495 roentgens.

It has been found that the gonads of males are about three times as sensitive as the gonads of females, and that the time for recovery is roughly proportional to the initial sensitivity. Likewise, the doses produced injured germ cells proportional to the dose, the largest dose producing, in males, about 96 per cent deformed embryos the first day after treatment. The total time for recovery of males treated with 1980 roentgens was 45 days, and the time for recovery for smaller doses was proportionally shorter.

There was a decided reduction in the number of eggs produced by treated females during the first 10 days, recovery to the normal number being accomplished by the twentieth day.

Susceptibility tests of developing embryos are being made as well as cytological studies of gonads and embryos.

3. The effects of x-radiation on the regeneration of the hydroid, Pennaria tiarella. William O. Puckett, Princeton University. (Introduced by C. F. W. McClure.) (Lantern; 15 min.)

The regeneration of amputated hydranths of the hydroid, Pennaria tiarella, has been prevented by exposure to x-radiation. Dosages of 10,000 roentgen units, or more, completely inhibit hydranth regeneration. Control colonies regenerate amputated hydranths after 36 to 48 hours.

Experiments made by radiating a portion of a colony, with the remaining connected portion protected from the radiation by a lead screen, indicate that the effect is a local one. Exposed portions of the colony fail to regenerate new hydranths, while the protected regions regenerate at a normal rate.

The effect of x-radiation appears to be primarily on cellular differentiation, rather than on cellular proliferation. In practically all cases of radiated branches of Pennaria, a mass of new tissue, sufficient to form a new hydranth, was formed but this tissue appeared unable to differentiate into hydranths. This latter observation agrees with our earlier studies on the non-regenerating limbs of x-radiated Amblystoma larvae (Butler, '33, and Puckett, '34). In these limb studies it was found that the loss of regenerative powers in the x-radiated limbs was due, in a great measure, to the inability of the cells of the limb stump to differentiate into new limb structures.

4. Individually specific blood inhibition of fertilization as an explanation of self sterility in the tunicate Styela. H. H. Plough, Amherst College. (Lantern; 10 min.)

A long series of tests extending over five successive seasons has shown that certain individuals of the tunicate Styela partita are self fertile, others show some self fertility but an increased amount of cross fertility, and still others are completely self sterile. These relations remain approximately constant in successive tests of the same individuals. Washing eggs in sea water gradually

removes the block to self fertilization. During the past season it has been found that the situation is similar in S. plicata of the coast of Florida, and in S. barnharti in California. Microscopical examination of sections of eggs exposed to their own sperm shows that the sperm penetrate the membrane and come to rest on the surface of the egg without entering. Treatment of eggs with dilute acids and bases, as well as blood from other individuals, simply reduces the percentage of eggs fertilized without influencing the differential between self and cross fertility. Finally samples of eggs of S. barnharti were allowed to stand in blood drawn from the same individuals, while other samples were washed in sea water. Fertilization showed in most cases a marked increase in the differential between self and cross fertility. Conversely washed eggs returned to their own blood regained the self sterility lost by washing. These results have been at least partially confirmed in the smaller S. partita by the use of blood and body fluid mixtures. The data suggest that self sterility in Styela results from an individually specific blood block to fertilization by the animal's own sperm.

5. Changes at the surface of Arbacia punctulata eggs prior to membrane elevation. Floyd Moser, University of Pennsylvania. (Introduced by L. V. Heilbrunn.) (Lantern; 15 min.)

A layer of granules, embedded in the inner margin of the cortical layer of Arbacia punctulata eggs, resists movement under the influence of high centrifugal forces.

During the normal fertilization process, the cortical layer granules break down in wave-like fashion, beginning at the point of sperm entry and ending at the opposite side of the egg. Membrane elevation progressively follows the wave of granule breakdown.

When the light portion, or the light fragments of centrifuged eggs are slightly punctured with a microdissection needle, cortical layer granule breakdown occurs in wave-like fashion, followed immediately by membrane elevation around the light pole. This membrane is the same as the fertilization membrane.

Artificial parthenogenetic agents cause a change at the surface of centrifuged and uncentrifuged eggs similar to that caused by sperm entrance. In the presence of saponin, the 'wave' and subsequent membrane elevation occur at the heavy pole first.

In all cases, breakdown of cortical layer granules is accompanied or followed by a disappearance of granules in the so-called fifth layer of centrifuged eggs. Following artificial stimulation, there is typically a cytolysis of this layer.

The above described phenomena do not take place in the absence of calcium. It is suggested that the reaction described is a surface precipitation reaction, involving a stimulus, the presence of calcium, the breakdown of granules, the subsequent release of the fertilization membrane and the establishment of a new membrane on the surface of the egg.

Future experimentation will be based upon the above observations.

6. Nuclear increase during development as a factor in differentiation and in heredity. E. E. Just, Howard University. (10 min.)

Observations made on eggs of echinids, molluscs and worms confirm earlier findings which show that during cleavage nuclear material increases. Since this increase occurs in hyaline fragments of eggs that develop and since it is more rapid in yolk-free than in yolk-laden blastomeres of an egg, e.g., of Nereis dumerilii, the author holds that the increased amount of nuclear material is at the expense of the ground substance. Since the ectoplasm also increases as the cytoplasm diminishes during cleavage the two factors, increase of nuclei and that of ectoplasm, parallel the loss of potency (genetic restriction) which characterizes development of both determinate and indeterminate eggs.

These measurable increases are made the basis of a theory of differentiation and of heredity. With nuclear increase substances (potencies) are removed from the cytoplasm and thus cytoplasmic reactions underlying differentiation are freed. Since genes are chromosomal units, it is suggested that they act as nuclei (aggregates of chromosomes). By removing material from the cytoplasm, genes release reactions in the cytoplasm whereby the cytoplasm-located factors for heredity express themselves as the characters used by geneticists. Thus, differentiation and heredity are two aspects of development.

7. On the effect of lithium chloride on cleavage and antipolar lobe formation in Sabellaria. G. B. Moment, Goucher College. (Lantern; 5 min.)

During the first cleavage of Sabellaria alveolata L. an antipolar lobe forms very like that of Ilyanassa or Dentalium. In an isotonic solution of LiCl the size of the lobe is reduced by a variable amount and a cleavage furrow appears running through it in such a way that approximately half of the lobe goes to each of the first two blastomeres which are thus made equal or subequal. Ameboid-like irregularities of the lobe were common in some eggs. Solutions of KCl, $CaCl_2$, KCN and $HgCl_2$ did not produce this result. If, as seems to be true, the formation of an antipolar lobe is due solely to factors located at the surface, then the action of LiCl in this case would appear to be a surface action.

8. Definitive localization in Fundulus. Jane M. Oppenheimer, Yale University. (Introduced by W. R. Coe.) (Lantern; 15 min.)

A tentative scheme of cell lineage has been worked out for an egg characterized by non-determinate cleavage. Vitally stained blastomeres of the sixteen-cell stage have been followed through to gastrulating stages, and locally stained areas of the gastrula have been traced to their sites in the differentiated embryo.

The embryonic axis bears no definite constant relation to the position of the cleavage planes, but coincides most frequently with the second plane. Four marginal cells of the sixteen-cell stage usually furnish the material for the early embryonic shield; this contains endoderm and mesoderm for the region of the first few somites as well as for the head, and material for all the nervous system posterior to the forebrain. The outer half of the remaining marginal cells of the sixteen-cell stage forms the germ ring, which contains endoderm and mesoderm for the posterior parts of the embryo. The remaining portion of the blastoderm

forms extra-embryonic membrane; the greater part of this membrane becomes yolk-sac epithelium, but some of its cells enter the shield anteriorly to form fore brain and eye.

Study of the cell lineage does not elucidate the nature of the processes occurring during cleavage stages, but it does demonstrate the roles played by the various blastomeres in normal embryo formation.

9. A STUDY OF INDUCTION IN THE CHICK BLASTODERM, WITH SPECIAL REFERENCE TO THE BEHAVIOR OF THE EPIBLAST. Gilbert L. Woodside, Harvard University. (Introduced by Leigh Hoadley.) (Lantern; 8 min.)

Chick blastoderms, ranging in age from the first appearance of the broad primitive streak to the 12-somite stage, have been grown 'in vitro' and a study made of the properties of the subordinate parts of the system. Chief emphasis was placed on an analysis of the ability of the epiblast to respond to inductive stimuli. Parts of the primitive streak, with or without Hensen's node, were employed as inducing agents.

The results obtained indicate that the younger the host at the time of transplantation the more pronounced its reaction to inductors, the ability to respond being inversely proportional to the developmental age of the host. The most complete production of secondary embryos is observed after transplantation to broad primitive streak hosts; whereas the power of reacting to inducing stimuli by the formation of the medullary plate is lost in embryos which have developed the first intersomitic groove. The region of the epiblast composed of presumptive epidermis remains in 'open term' relative to the formation of medullary plate until the establishment of the neural folds.

In connection with the above experiments a study was made of possible causes of curved embryonic axes. It was found that marked curvature is obtained in embryos in which uni-lateral removal of endoderm is followed by regeneration, as well as in a few embryos to which transplants have been made. The experiments indicate that bent embryonic axes do not provide sufficient evidence to prove a "directional influence due to the endoderm."

10. AUXIN FROM CHICK EMBRYOS. True W. Robinson and Gilbert L. Woodside, Harvard University. (Introduced by Leigh Hoadley.) (Lantern; 7 min.)

Auxin has been found in the urine of mammals, in blood, in muscle tissue, and in the eye-stalks of Palaeomonetes. Two new sources are reported here; chick embryos and blow-fly larvae. In the chick quantitative determinations have been made on the amount of auxin obtainable from the unincubated egg and from embryos of various ages.

The amount of auxin obtainable from an unincubated ovum plus its albuminous envelopes is much less than can be obtained later from the embryo alone.

The amount of auxin in the embryo is directly proportional to the wet weight during the first 7 days of incubation. The concentration of auxin per milligram of wet weight varies considerably from the eighth to the fourteenth day of incubation. From the twelfth day to hatching the total amount of auxin present in the embryo decreases.

At present the results would seem to indicate: 1) That auxin is actually formed by the chick embryo and not obtained directly from the remainder of the egg. 2) That in the early embryonic growth the production of auxin and the increase in weight are closely correlated.

11. The relation of the lymphoid tissue of avian bone marrow to erythrocyte production. H. E. Jordan, University of Virginia. (Lantern; 15 min.)

The segregation in avian marrow of the progenitors of the erythrocytes and granulocytes in sinuses and intervascular stroma, respectively, gives basis for the support of the dualistic concept of blood development as urged by Denys, Bizzozero, van der Stricht, and Sabin. Recognizing the sharp delimitation of areas of erythropoiesis and granulopoiesis, Dantschakoff interprets the evidence as supporting the monophyletic theory of hemopoiesis; she identifies common mother cells, the large lymphocytes or hemocytoblasts, which migrate from the stroma into the venous sinuses where they ripen into erythrocytes. Though earlier investigators recognized genuine lymphoid tissue, they apparently failed adequately to appreciate its relatively great total bulk. Moreover, the earlier descriptions make no mention of nodules with germ centers. The significance of lymphoid nodules with reference to erythropoiesis has not heretofore received consideration. Correlated with the absence of lymph nodes in birds is the widespread occurrence of lymphoid tissue in marrow, liver and rectal ceca. The lymphoid nodules of the bone marrow of pigeons and chickens are identical with the splenic, hepatic and cecal nodules. They consist typically of a germinative center of larger lymphocytes (hemocytoblasts) and a mantle of small lymphocytes (lymphoid hemoblasts). The peripheral small lymphocytes, daughter cells of hemocytoblasts of germ center, migrate in part into adjacent sinuses, in part into intervascular stroma. In both regions they grow in size and acquire features similar to those of the ancestral cell. Apparently identical cells differentiate into erythrocytes within the venous sinuses and into granulocytes in the intervascular stroma.

12. Early stages of calcification in the rat embryo. E. Alfred Wolf and Thomas F. McBride, University of Pittsburgh. (Lantern; 10 min.)

The beginning of calcification in long bones, vertebrae and skull is studied by means of the Gomori modification ('33) of the silver nitrate method.

13. On the development of thyrotropic function in the hypophysis of the tadpole. William Etkin, College of the City of New York and American Museum of Natural History. (Lantern; 12 min.)

The problem of the mechanics of anuran metamorphosis has been analyzed to the point where it is clear that the hypophysis stimulates the thyroid at one point in the life cycle and the resultant activity of this gland determines the pattern and time of metamorphic events. An attempt is here made to further the analysis by discovering the nature of the factors determining the time of development of the thyrotropic factor in the hypophysis. The method used was grafting of hypophyseal primordia and of glands from tadpoles in various stages

of development into hypophysectomized hosts. The common eastern species of Rana were used. The following essential points have been thus established: 1) The thyrotropic hypophysis in a living graft is usually inhibited. The metamorphosis which it induces is generally delayed and protracted. 2) A primordium may, however, develop to full and normal functional activity in a strange site. 3) The presence of an excess number of hypophyses may result in a precocious and condensed metamorphosis.

The following theory of hypophyseal development is suggested to explain these facts: The physiological development of the thyrotropic hypophysis is gradual and continuous and not subject to any outside specific stimulation (nervous or hormonal) for the development of its function. The degree of thyroid response is proportionate to the amount of thyrotropic hormone. Thus the time of metamorphosis and the pattern of its events depend ultimately upon the inherent developmental pattern of the hypophysis.

14. The development of limbs in frog larvae subjected to salts of various metals. A. Emerson Warren, McMaster University. (Introduced by A. B. Dawson.) (Lantern; 7 min.)

The inhibitory effects of zinc upon limb development in Rana fusca have been demonstrated (Dürken, Biologica Generalis, '30, '31). During the past 2 years experiments have been made with young larvae of Rana sylvatica subjected to the influences of several heavy metals. Normal larvae, and those with an eye removed, were placed in ordinary tap water or in dilute solutions of salts of Li, Ca, Mg, Al, Mn, Zn, Cr, Cd, Co, Ni, Pb, Fe, Cu, La and Ce for varying periods. All were given similar diet and were treated in quite similar manner throughout the experiment.

Dilute solutions of Fe and Cu proved very toxic, and heavy mortality resulted. Sub-lethal concentrations of Li, Ca, Zn, Cd, Ni and Pb retarded the growth and development of larvae to a marked degree. When these larvae were transferred to tap water, they slowly recovered and appeared normal in their subsequent development. No pronounced inhibitions were observed in larvae kept in the other metals, even in solutions of relatively high concentration.

Defective hind limbs were found in only 1.4 per cent of the 2177 individuals examined. In 0.6 per cent of them mild inhibitions in the formation of digits were noted. Abnormal cases occurred among larvae reared in Ca, Mg, Cd, Zn, Mn and La, as well as among the controls.

There appears to be no correlation between defective limbs and the absence of an eye.

The foregoing data are inadequate evidences that metals in solution greatly affect the development of limbs in Rana sylvatica.

15. The continuity of the germ cells in the urodele, Plethodon cinereus (Green). J. Wendell Burger, Princeton University. (Introduced by E. G. Butler.) (Lantern; 15 min.)

Plethodon cinereus is extremely favorable for a study of the continuity of germ cells from the embryo through the adult sexual cycle. The gonads are small, while the cells are large. The primary spermatogonia are confined to

clusters at the central end of ampullae, which are arranged fan-wise about a longitudinal duct. Spermatogenesis proceeds peripherally from the primary spermatogonia, which are clearly isolated and are readily distinguishable from non-germinal cells.

A complete series of salamanders from the egg through the adult cycle was used. During embryonic stages the germ cells can be distinguished by the presence of yolk spherules, which are quickly lost in neighboring non-germinal cells. Cell counts were made of gonads where every germ cell contained yolk, and also the number of primary gonia in the adult gonad were counted. It was found that mitoses necessary to produce the maximum number of yolk-containing cells were about two-thirds the mitoses necessary to produce all the primary gonia of the adult. Furthermore, the number of spermatogonial mitoses necessary to produce the spermatozoa for one cycle is as great as the mitoses of the primordial cells necessary to produce the adult complement. In males starved 4 months, abundant spermatogonial mitoses were found. These observations, together with the cytological evidence, indicate that the germ cells of adult Plethodon cinereus are descended solely from a small number of germ cells in the embryo.

16. Micro-moving pictures of ovulation and egg transport in the frog. Roberts Rugh, Columbia University and Hunter College. (Cinema; 15 min.)

This film demonstrates contractions in the lobes of the frog's ovary independent of ovulation; normal rupture and emergence of eggs from their follicles; rupture of follicles and emergence of eggs from the follicles in ovaries of sexually inactive frogs, induced by pepsin-HCl; ciliary transport of recently ovulated eggs over peritoneal epithelium; active cilia on liver; eggs approaching the ostium; eggs entering the ostium; and eggs rotating in and progressing through the oviducts.

This film demonstrates the thesis that ovarian contractions occur at all seasons, independent of ovulation, and may have circulatory value; that the coelomic cavity is abundantly supplied with cilia which propel eggs toward the ostiae; that entrance of eggs into the ostium is the result of ciliary forces and not of a 'gaping open' of the ostium at each beat of the heart; that within the oviduct the eggs are rotated spirally as they are propelled forward, causing an even deposition of jelly on the surface of the egg.

17. Complete and reduplicated shoulder girdles and associated muscles resulting from transplantation in the urodele embryo. Isabel H. Blount, University of Minnesota. (Introduced by A. R. Ringoen.) (Lantern; 15 min.)

Complete cartilaginous shoulder girdles were obtained on the flank in urodeles by the transplantation of grafts 5 somites long from the fore limb area. All muscles developed normally except the extrinsic group to the girdle. Of these the trapezius was present only in those cases in which gill material had been included in the graft and an extra set of gills had developed contiguous to the limb. Muscles corresponding in their insertions to the serratus and levator scapulae were sometimes found arising from nearby myocommata, and often there were others connecting unusual parts of the girdles with the body wall and each other. If the graft is placed too far posteriorly its girdle may partly fuse with that of the hind limb, or the latter may be entirely suppressed.

Reduplicated shoulder girdles produced in the normal site by rotating 5-somite grafts were also studied. These ranged from a single girdle with two glenoid cavities through those in which the coracoid or scapula alone was doubled, up to two complete girdles connected in various ways. Single disharmonic girdles were also produced. Unless extra gills were found posterior to a disharmonic girdle the trapezius was again lacking.

The species employed in the experiments were Ambystoma maculatum (Amblystoma punctatum) and Triturus torosus at stages 36 to 40.

18. Correlated genetic and embryological experiments on Triturus. I. Hybridization: Development of three species of Triturus and their hybrid combinations. Victor C. Twitty, Stanford University. (Introduced by C. H. Danforth.) (Lantern; 8 min.)

Three species of California Triturus (T. torosus and two others discovered only recently, T. similans and T. rivularis, Copeia, July, '35, Twitty) were hybridized artificially in all reciprocal combinations. Hybrid development is described with particular reference to larval pigmentation, and the condition of the balancer and dorsal fin. The normal pigment patterns in larvae of the three species differ primarily in the extent of melanophore distribution over the body, varying in degree from a sharp and permanent segregation into two dorsal bands in torosus; a transient segregation of related but less striking character in young similans, giving way in older stages to a diffuse distribution on back and sides; to the condition in rivularis where the melanophores are uniformly and widely scattered throughout larval development. In hybrids the sperm influence is patent from the first appearance of pigmentation, and results ultimately in a compromised or intermediate distribution of the pigment cells.

The balancer, always present in normal torosus and similans, is either absent or vestigial in rivularis. In hybrids involving the latter species the balancer tends to be intermediate in size. Its degree of development is much more uniform in rivularis ♀ × torosus or similans ♂ crosses than in the reciprocal hybrids, where it is not infrequently lacking.

The dorsal fin, which extends the full length of the trunk and tail in torosus and similans, is absent on the anterior portion of the trunk in rivularis. In rivularis × torosus or similans hybrids its extent on the trunk is approximately intermediate between the parental conditions.

19. Correlated genetic and embryological experiments on Triturus. II. The embryological basis of species differences in pigment pattern. Victor C. Twitty, Stanford University. (Introduced by C. H. Danforth.) (Lantern; 7 min.)

Melanophores of the amphibian skin develop embryologically from cells of the neural crest (DuShane, Holtfreter). By transplantation it is shown that the differences in the ultimate arrangement of these cells in the three species of Triturus are attributable principally to specific differences in the properties of the developing melanophores themselves. In each species other constituents of the embryo, particularly somites and neural tube, are showed to play important roles in the development of pigment pattern, but these environmental

agencies are essentially alike in the various forms, hence exert no differential influence. When crest cells are replaced experimentally by those of another species, using care not to disturb other relationships within the host, the grafted melanophores give rise subsequently to a pattern typical of the donor species. The transplantation of neural crest from hybrid embryos to normal hosts of a parental species gives similar results, in that the hybrid pattern is reproduced perfectly at the level of the graft. From this one may infer that the influence exerted by the sperm on hybrid development, in so far as the determination of pigment pattern is concerned, is confined primarily to a modification of the properties of the pigment forming cells themselves. The possible nature of the properties affected is discussed on the basis of the behavior of melanophores of different species under various experimental conditions, particularly of heterotopic transplantation.

20. Transplantation experiments on the hind limb of Amblystoma tigrinum. Walter Alva Stultz, University of Georgia School of Medicine and Yale University. (Introduced by A. Petrunkevitch.) (Lantern; 10 min.)

The hind limb rudiment of Amblystoma tigrinum has been localized in the tail bud stages, as a disc of tissue 4 somites in diameter centered ventral to myotome 17 and extending to the anal region. After extirpation of this area a limb regenerates unless the wound is covered with indifferent tissue. Such regeneration occurs more readily than in A. punctatum following similar operations.

The hind limb is shown to be a self-differentiating equipotential system from the following results: development of a normal limb following 1) transplantation of the rudiment to the normal or to an indifferent region of the body, 2) complete or partial removal of the rudiment, 3) rotation of the rudiment at transplantation, with accompanying disarrangement and reorganization of its parts. It is thus similar to both fore and hind limbs of A. punctatum.

The relations of symmetry of the limb were tested by grafting the rudiment to both normal (orthotopic) and abnormal (heterotopic) locations, and to the same side as well as the opposite side of the body to origin, with orientation both normal and upside down.

Resorption occurred in a large proportion of heterotopic grafts; this is more marked than after similar operations in A. punctatum. Reduplications were practically nil.

The symmetry relations of heterotopic limbs agree with the fore limb rules of Harrison; the limb develops disharmonically when its anteroposterior axis is reversed in grafting. Orthotopic limbs, on the other hand, develop harmonically irrespective of the side of origin or the orientation of the graft.

21. Factors concerned in the development of the ear in Amblystoma punctatum. Ross G. Harrison, Yale University. (Lantern; 15 min.)

When the hindbrain region of one side is removed in the early medullary plate stage and replaced by presumptive ventral ectoderm, an ear vesicle develops from the graft in normal position. Reciprocally the hindbrain graft may induce the formation of an ear from the strange ectoderm covering it. Likewise, when

grafted in place of a segment of the spinal cord, it may induce a supernumerary ear. If the mesodermal substratum is removed with the hindbrain, either a rudimentary otic vesicle or none at all develops. Although at the stage of the operations practically the whole ectoderm retains its potency to form ears under proper stimuli, the area destined normally to form the ear has this potency to a greater degree, as shown by the more complete ears formed from it when grafted over the wound after removal of both hindbrain and substratum. The conclusions are drawn: 1) that the particular area forming the ear realizes this potency under the influence of a particular area of mesoderm; 2) that this induction power is imparted to a spot in the medullary plate that continues for a time to act in the same sense; 3) that both primary and secondary inductors act in producing the ear in normal development. If one likes the expression, one might speak here of 'triple assurance.' However, it seems better to refer the observations to the circumstance that the process of induction covers a considerable period of time.

22. The totipotency of regenerates in urodeles tested by some new methods. O. E. Schotté, Amherst College. (Lantern; 15 min.)

No abstract received.

23. The effect of hydrogen ions in regulating the intensity of mutual inductions and in inducing polarity in Fucus eggs. D. M. Whitaker, Stanford University. (Introduced by C. V. Taylor.) (Lantern; 15 min.)

The Fucus egg is spherical. After fertilization a protuberance develops at one side (involving softening and extension of the cellulose wall), which indicates the polarity. The protuberance gives rise to the rhizoid of the new organism; the rest of the egg, the thallus.

In normal sea water containing masses of ten or more eggs per dish, rhizoids develop on the sides of eggs in the resultant direction of neighbors. However, two eggs alone in a dish have no mutual inductive effect, nor do five eggs. In sea water buffered at pH 6.0 all groupings show strong intensified induction. Two eggs alone in a dish are now mutually inductive over a distance of five or six egg diameters.

Eggs develop perfectly at pH 6.0, slowly at 5.5, and not at all at 5.0. By means of micro-diffusion pipettes, pH gradients have been established across many individual eggs. The rhizoid develops at the region of high hydrogen-ion concentration (pH about 6.0) unless the pH is lowered to the inhibiting range (e.g., 5.5) in which case the rhizoids originate away.

A known substance, hydrogen ions, thus induces rhizoid formation and determines the whole developmental pattern. It therefore acts as an organizer. An hypothesis tentatively proposed, pending further tests, is that a link in the chain may be action on the cell wall by the hormone auxin which is rendered more active by hydrogen ions. All means of induction now known in Fucus could resolve to this underlying interaction.

24. Determination of limb-axes. F. H. Swett, Duke University School of Medicine. (Introduced by B. H. Willier.) (Lantern; 15 min.)

A brief review of the subject, together with a summary of some experiments designed to alter the speed of the process. Limb-axis differentiation is discussed from the point of view of the relation between the developing limb and its surroundings.

25. Early developmental phenomena in the macaque and their significance in primate embryology. George L. Streeter, Carnegie Institution of Washington. (Lantern; 15 min.)

It is found that the cells composing the inner cell-mass region include both formative (embryonic) cells and non-formative (trophoblastic) cells. The segregation and differentiation of these two categories of cells can be traced with considerable accuracy in the stages that have now become available. What is found in these early stages of the macaque embryo makes it necessary to limit the terminology of the three germ layers to embryonic or formative cells. The developmental transformations in the non-formative or trophoblastic tissues do not conform to the requirements of the classical germ layers.

26. The development of the rat egg in altered surroundings. John S. Nicholas, Yale University. (Lantern; 15 min.)

The experimental studies which have been performed in recent years have shown that the rat egg can be studied over a wide range of variation in the experimental procedure. The conditions which may be varied concern 1) the location and implantation of the egg; 2) the capacity of the egg to form tissues and organs in normal and abnormal relationships; 3) the capacity of the egg to form total embryos when transplanted to the uterus as a total egg, as one of the first two blastomeres, or as a fusion of two total eggs.

A comparison of differentiation within the uterus with that obtained elsewhere shows that the uterus acts as an agent in restraining differentiation, a function which it shares with the extraembryonic membranes which are closely associated with the embryo. These combined factors are responsible for the organization which is found in intrauterine transplants. In abnormal locations where these forces of restriction are not present the embryonic parts differentiate and proliferate often tremendously in advance of the normal but without the organization and form which occur in the restricted condition.

27. Zenoplastic experiments on amphibians. Johann Holtfreter. (Introduced by B. H. Willier.) (Lantern; 15 min.)

Zenoplastic transplantation, that is the exchange of tissues between representatives of different orders is usually impossible with adult animals. Such operations can, however, be easily performed with embryonic material. The experiments to be reported consisted of transplantations between anura and urodeles and were done in an effort to analyze both the morphogenetic and physiological relations obtained in such a combination. The operations, done

in the early gastrula stage, consisted either of exchanges of large portions of ectoderm or, by explantation, the combining of isolated organizer-material with ectoderm of an embryo of another order. Since the specific rate of growth and differentiation is different in the two animals, tissues remain easily distinguishable.

By the exchange of portions of presumptive medullary plate between certain species of frog and triton it has been shown that the size of the plate is not determined by its origin, but by the area of the inductive material which lies beneath it. The speed of closing and the histological behavior of such zenoplastically induced plates are, however, in accordance with those of the donor. For example, having substituted the ectoderm of the later head region of a triton by ectoderm from any part of the frog, we obtain a brain in its proper position with the proper (for triton) relation of eyes, ear vesicles, ganglia, etc. However, according to their histological differentiation these organs have developed as frog tissue. Not only may the various products of the neural plate be produced by zenoplastic induction, but such products of the ectoderm as eye lens, nose, mouth, teeth, cartilage, pigment cells, etc., may also be obtained in this manner. These tissues, together with the component tissues of the host, may combine in forming harmonious chimaeric organs. Since, through the effect of triton inductors the usual suckers and horny teeth are produced in frog ectoderm and since in a reciprocal fashion balancers and dentine teeth are induced in the triton ectoderm, we must conclude that there is no great specific difference in the action of the inductors, but that this difference lies in the specific reacting ability of the induced tissue. Certain abnormalities occurring in the chimaeric organs leads to a further explanation of the mechanism of determination in early development.

Similar zenoplastic combinations of ectoderm and inductors can be made by explantation and show that all of the above mentioned organs can be obtained. In each case the regional character of the organizer in these isolated organs determines the character of the induction.

By demonstration

28. Early stages in the development of the swimbladder in Hemichromis bimaculata. Robert S. McEwen, Oberlin College.

Microscope slides and photomicrographs will be presented showing the development of the swimbladder in the fish, Hemichromis bimaculata, from the time of its origin to the point where it appears as a large thin walled vesicle. Development in this tropical form is very rapid, and the ages and lengths of the stages shown will be indicated.

29. Chromosome numbers in androgenetic embryos of Triturus viridescens. G. Fankhauser and C. T. Kaylor, Princeton University.

A number of the androgenetic embryos of Triturus viridescens obtained in the puncturing experiments of C. T. Kaylor (see the following abstract) were sectioned, together with the normal control embryos, for a preliminary cytological study.

Nine control embryos, fixed at various stages from blastula to neural tube, showed twenty-two chromosomes in the mitotic figures the normal diploid number as established in a previous study of cleavage mitoses (Fankhauser, '32). Two control embryos were triploid (thirty-three chromosomes).

Out of nine androgenetic blastulae and gastrulae, three were found to be haploid (eleven chromosomes), while six contained various deviating numbers ranging from seven to over twenty. One older embryo with closed neural tube showed eleven chromosomes in all the mitoses that could be analyzed.

In three additional androgenetic blastulae a considerable number of cells were present that contained well-developed asters or spindles but no nucleus or chromosomes, a condition described before in merogonic blastulae of Triton palmatus.

An irregular distribution of chromosomes in early cleavage stages has been found to be the main cause of the high mortality in the blastula and gastrula stages of merogonic embryos of Triton palmatus and Triturus viridescens (Fankhauser, '32, '34). The results of this preliminary cytological study of androgenetic embryos of Triturus viridescens indicate that, here also, abnormal combinations of chromosomes are an important cause of the early cessation of development in the majority of cases, while purely haploid embryos may develop to more advanced stages.

30. Experiments on androgenesis in Triturus viridescens. Cornelius T. Kaylor, Princeton University. (Introduced by G. Fankhauser.)

Eggs of Triturus viridescens were removed from their capsules approximately 5 minutes after insemination. From 5 to 30 minutes after fertilization, the yolk membrane was punctured several times with a thin glass needle above the first polar body, and with a fine pipette a small amount of cytoplasm including the second maturation spindle was removed (Dalcq's method modified by Curry, '31).

In 136 cases this operation was successful. Fifteen of these eggs showed no cleavage, in nine the cleavage was very irregular and incomplete, in ninety-one irregular but complete, and in twenty-one practically normal. In the great majority of operated eggs, the cleavage was typically delayed, as it is in merogonic egg fragments of Triton (Fankhauser, '25) and of Triturus viridescens.

Out of the 112 cases in which the cleavage was complete, thirty-two were preserved in early stages for cytological examination, nineteen reached a middle blastula stage, forty-one developed as far as a late blastula stage, and nine completed their development during gastrulation. Only eleven embryos gastrulated normally. In these, development came to an end in stages ranging from an open neural plate to a young larva with three gills, long balancer, and well-developed fore limbs.

These results show that puncturing experiments are more likely to produce a considerable number of haploid embryos than constriction experiments in Triturus viridescens (Fankhauser, '32) in which so far not a single merogonic egg fragment has developed beyond the gastrula stage.

31. Life histories of three species of California Triturus, including two new species. Victor C. Twitty, Stanford University. (Introduced by C. H. Danforth.) (Charts and specimens.)

See abstract no. 18.

32. Development of hybrids in various combinations. Victor C. Twitty, Stanford University. (Introduced by C. H. Danforth.) (Charts and specimens.)

See abstract no. 18.

33. Devices for experiments on amphibian embryos. Walter Alva Stultz, Yale University and University of Georgia School of Medicine. (Introduced by A. Petrunkevitch.)

Various plastic modeling materials have been tested for their suitability as a substrate to be used in operating dishes for amphibian embryos. 'Permoplast' has been chosen as the most suitable since it is non-toxic, of fine texture and consistency and is easily molded about the embryo in situ.

'Pin-celluloid' and 'pin-glass' graft covers have been developed in order to provide an instrument for holding the graft in place during healing, while at the same time it is easily adjustable to the plane of the graft, covers its entire surface, may be applied with the correct pressure, and affords clear vision.

Observation chambers have been devised for holding Amblystoma larvae without anaesthetizing them during periodic examinations of the developing graft. The chamber is constructed of glass and encloses the larva in such a way that it may be observed from any side. A graded series of chambers accommodates embryos of increasing sizes.

Paper dishes have been used successfully in place of glass finger-bowls for raising larvae over long periods of time.

34. Early stages of calcification of bones in vertebrates. E. Alfred Wolf, Thomas F. McBride and Harry J. Lipman, University of Pittsburgh.

Demonstration of whole mount preparations, photographs and microscopical sections showing calcified skeletal areas by means of the Gomori modification of the silver nitrate method and the alizarin red S method. The usefulness of the methods for comparative anatomical, embryological, histological and physiological studies is shown.

By title

35. The germinal vesicle of the egg of Sabellaria vulgaris, a polychaete annelid. A. J. Waterman, Williams College.

Within a period of 8 minutes after shedding, the egg will cytolyze and burst in distilled water, liberating an intact swollen germinal vesicle. This persists for hours without change. There may occur an aggregation of larger granules at one side in the vicinity of the nucleolus. The elasticity of the wall is limited and some may form small exovates, with thinner walls, which are not soluble. The diameter of the vesicle thus decreases slightly, but the membrane does not wrinkle.

In sea water the vesicle may shrink to approximately its original diameter. Adjacent vesicles do not adhere. No prematuration changes characteristic of the egg nucleus occur. There is no visible change during many hours or reaction on the part of the sperm. Various vital acid and basic dyes penetrate the

membrane and color the nucleoplasm and granules. No specific structure is thus demonstrated. The dyes together with indicators give an internal pH between 6 and 7, but this value will vary in harmony with that of the external medium. After long exposure to distilled or sea water the membrane loses its elasticity.

In hypertonic sea water or NaCl, the vesicle shrinks at first uniformly and with a smooth surface. Later the surface becomes crenated or even indented with further loss of water. These seem to indicate the presence of an insoluble elastic solid surface layer or membrane which is in a state of tension. It hardens on exposure and also is permeable at least to water and certain vital dyes.

36. Tissue specificity in development. A. J. Waterman, Williams College.

According to Castle and Keeler, the erythrocytes of the rabbit carry two agglutinogens which cause four blood groups and these appear as early as the fifteenth day of gestation. Transplants of rudiments of younger rabbit embryos to the kidney and omentum of adults of the same species exhibit a thick incorporation with excellent survival and differentiation, or show scanty incorporation with little differentiation and much degeneration, or they may never take. This occurs regardless of whether the mother is used, or a different host of either sex. Prerudimentary embryos give uniformly poor results. Young or half-grown hosts give results similar to those of the adult. Rudiments of an embryo may take in one host and leave little or no trace in another. Chorioallantoic transplants of these rudiments survive for a shorter time and fewer take, but thus far they are more successful than in the adult rat. Embryonic tissue of an animal of another class is apparently more tolerant than adult tissue of a more closely related host, but specificity seems evident even between embryonic tissues. Undoubtedly the factors conditioning the success of a transplant include poor location, faulty or delayed vascularization, infection, injury, host tissue antagonism, etc., but it may be that biologic differences, other than blood groups, appear in the tissues of very young rabbit embryos before differentiation has advanced far, and the method of transplantation furnishes a delicate test. The early appearance of individual specificity might account in part for graft retardation or failure.

37. Embryology and histology of the anal fin of Platypoecilus maculatus. Leonard Grumbach, Cornell University.

All of the skeletal, muscular, and supporting elements of the fin arise from sclerotomic mesoderm which splits off from the somite at an early stage. Differentiation of the trunk muscles is quite advanced before differentiation in the fin occurs; there is no evidence that they contribute any material for the formation of the fin musculature. The baseost and interspinous bone anlagen develop first. Myoblasts then orient themselves in respect to these structures to form the fin musculature. The first pair of muscles to appear are the erectors which have their origin on the next caudal interspinous bone; the depressors have their origin on the interspinous bone of their own segment; and the inclinators on the ventral tip of the trunk muscles.

The remaining sclerotomic material differentiates into fibroblasts. Some of these form the actinotrichia and lepidotrichia by secreting collagenous fibers under the basement membrane; the cells responsible for the former are smaller than those which secrete the latter. Both types differ in appearance from the fibroblasts forming the reticular connective tissue which is continuous with the corium of the body wall. Later the lepidotrichia become infiltrated with calcium.

38. Prospect and potency in a urodele blastula subjected to a transverse thermal differential. Francis G. Gilchrist, Pomona College.

Observations with spots of vital dye and with sections show that when a urodele blastula is warmed on one side and cooled on the other, the pattern of the prospective organ rudiments is modified. 1) The position of the early dorsal lip of the blastopore is not changed; 2) that of the prospective later lip is slightly shifted toward the warmed side. 3) The area of the prospective mesoderm of the warmed side is increased and extends above the equator; that of the cooled side is decreased and is below the equator. 4) The prospective neural area as a whole is shifted toward the warmed side, but the neural axis is but little shifted. 5) The anterior tip of the neural plate and the sensory plate are shifted toward the cooled side and face the blastopore across the cooled flank. This asymmetry of neural material reflects the greater descent, involution, and forward and lateral streaming of the mesoderm on the warmed side; also its more intense and extended development of neural plate-inducing powers.

It is concluded that the blastula possesses a simple, labile physiological pattern or gradient field, which is anchored in the differentiated material (dorsal plasm) of the early dorsal lip, but which elsewhere is subject to distortion by a transverse temperature differential in much the fashion that a tree is blown before a wind. The invisible differentiations of chorda and mesoderm are localized in spatial relation to this dynamic pattern, and their future differentiating and inducing powers determined.

39. A histological study of larval transplants to the adult newt, Triturus viridescens viridescens. Henry Idzkowsky, University of Pittsburgh. (Introduced by H. H. Collins.)

In this study, larval fragments of the newt, Triturus viridescens, were transplanted to the adult form. Observations showed the following:

The alimentary tract and its derivatives are the least resistant to post-operative disturbances. Remnants of the tract are found only in a relatively small number of the older transplants.

The nervous system, as well, is quite non-resistant. It persists only in approximately one-third of the transplants. However, in those cases where there is a persistence of nervous tissue, the brain degenerates to a great extent, but the lower portion of the medulla and spinal cord survive as a structure quite similar, histologically, to embryonic spinal cord.

Muscle tissue at first undergoes extensive degeneration. Nevertheless, surviving fragments proliferate later, and new muscle tissue arises, as well, from undifferentiated mesenchyme, so that 40 days after transplantation there is an abundance of this tissue present. At this time it has reached a developmental stage similar to that of muscle found in very late aquatic larval stages.

The epidermis, 6 days after transplantation, retains its original form in having two layers of cells and numerous Leydig cells. Forty days after transplantation the epidermis is more nearly like that of the adult; no Leydig cells are present, it is considerably thickened and it possesses a fully cornified layer. This condition approaches that found in postmetamorphic forms. In a few cases, at this period, multicellular gland anlage were present.

The loose connective tissue of the transplant is abnormally active. It is especially active in replacement reactions.

40. Effects of lack of iodine upon amphibian growth and metamorphosis. W. Gardner Lynn and Charles Brambel, Johns Hopkins University.

Fifty cultures of Rana sylvatica eggs were divided into four groups and subjected to the following experimental procedure. Twelve cultures contained fifty eggs each in 100 cc. of distilled water, thirteen contained fifty eggs each in 100 cc. of a 0.000,001 M. solution of iodine in distilled water; two other series were similar, but tap water was used. The fluid was changed daily and the tadpoles were fed rolled oats, a diet of extremely low iodine content. Onset of metamorphosis, as evidenced by growth of hind limbs, first occurred in the tap water-iodine cultures at the end of 27 days. At 35 days it occurred in the distilled water-iodine series, and at 41 days in the tap water series. Completely metamorphosed individuals appeared in the tap water-iodine cultures at 51 days, in the tap water cultures at 64 days.

Nearly all individuals in both tap water series metamorphosed successfully. Those in distilled water-iodine underwent elongation of hind limbs but a high mortality occurred shortly following. Animals in distilled water alone showed no signs of hind limb growth although they were kept for 116 days. It appears that, although distilled water is not a favorable environment, tadpoles can grow in it and even begin metamorphosis if sufficient iodine is available; but they succumb to the unfavorable conditions during this critical process. If iodine is absent from the environment and diet, metamorphosis is not initiated and the animals thrive well beyond the normal period of larval life.

41. Cholesterol content and iodine deficiency in developing tadpoles. Charles E. Brambel and W. Gardner Lynn, Johns Hopkins University.

The existence of a relation between blood cholesterol and thyroid activity has been shown by several clinical investigators. In hypothyroidism the concentration of blood cholesterol is raised while in hyperthyroidism it is slightly lowered. By experimentally modifying the iodine content of the diet and environment of developing Rana sylvatica tadpoles a corresponding relation was demonstrated in them. Since the determination of blood cholesterol was impracticable, the total cholesterol content of the animals was assayed. Two large series of individuals were compared: 1) those growing in an iodine-free environment, and 2) those growing in an environment to which elemental iodine had been added. The total cholesterol content of individuals in the iodine-free cultures was 53 per cent greater than that of the control animals. It is supposed that in the former the thyroids did not develop normally or were inactive and that their higher cholesterol content is correlated with this hypothyroid condition.

42. Observations on the anuran pancreas during metamorphosis. R. G. Janes, New York University. (Introduced by O. M. Helff.)

During metamorphosis the anuran pancreas undergoes reduction comparable in extent to that of the alimentary canal. The pancreas of the Rana clamitans larva reaches its maximum size when the posterior limbs are well differentiated. Before the forelimbs perforate the operculum, however, the gland begins to degenerate and it is progressively reduced in size until involution is nearly complete. At this time the organ becomes more compact and increases slightly in size due to the regenerative phenomena which occur.

Numerous techniques have been employed in studying the pancreas histologically. In Rana sylvatica many of the acini degenerate at the onset of metamorphosis and the condition is progressive in various parts of the organ. Zymogen granules, which are so prevalent in the tadpole, gradually disappear in the histolyzing cells, but remain in the retained exocrine cells and may increase in size although they are reduced in number. Numerous zymogen granules are found again in the acinar cells at the close of metamorphosis. The islands of Langerhans persist throughout involution and consist of small groups of cells, located between the acini, and surrounded by loose connective tissue and sinusoidal capillaries. Moreover, by using differential staining, single island cells have been found irregularly distributed among the acini. A histological comparison is being made of the pancreas in both the larval and adult stages of Rana clamitans, Rana catesbiana, Rana sylvatica, Hyla crucifer, and Hyla versicolor, together with a study of the changes which occur in each species during metamorphosis.

43. Observations on the development of some Anura. Karl A. Youngstrom, University of Kansas. (Introduced by H. B. Latimer.)

The species studied were Pseudacris triseriata, Bufo woodhousi, Rana pipiens, Acris gryllus, Rana areolata, and Rana clamitans. Complete observations have been made only on the first three named species.

At hatching Pseudacris triseriata, and Acris gryllus are free swimming; Bufo woodhousi mostly premotile; the Rana are just becoming motile.

Reactions to light touch with a fine human hair first occur at 3 mm. in Pseudacris triseriata, 4 mm. in Acris gryllus, 5.3 to 5.5 mm. in Bufo woodhousi, 6 to 6.5 mm. in Rana pipiens and areolata, and 5.5 to 6 mm. total body length in Rana clamitans.

Spontaneous eye movements were apparent in all tadpoles studied except those of Bufo woodhousi.

In Pseudacris triseriata, Bufo woodhousi, and Rana pipiens, body reaction to rotation first occurs at 12 mm., 11 to 12 mm., and 16.5 mm., respectively; hind legs of these species become motile at 23 to 24.5 mm., 20 to 21 mm., and 51 to 56 mm., respectively. The earliest limb movements are apparently always associated with the mass movements of the organism. Independent leg reflexes first occur in these species at 27 to 29 mm., 22 to 23 mm., and 63 mm. up, respectively.

The total body length was found to represent the degree of development more accurately than the age.

44. The origin of the notochord in Alligator mississippiensis. A. M. Reese, West Virginia University.

Study of sections of early stages of the alligator embryo seems to show that the notochord is derived from the entoderm rather than from the mesoderm.

45. The ossification of the chick skeleton. I. The wing and leg. Carl J. Sandstrom, New York University.

The ossification of the wing and leg bones was studied in a series of embryos (stained and cleared in toto preparations) consisting of ½-day stages ranging from 7 days' incubation to hatching.

Primary ossification centers of the component parts of the wing appeared as follows (in days of incubation): humerus, 8; ulna, third metacarpal, 9; radius, fourth metacarpal, 10½; proximal phalanx of third digit, 13, of second digit, 13½; distal phalanx of third digit, 15; of second digit, 19; of fourth digit, 21. These observations differ markedly from similar studies reported in the literature. It was also noted that the typical, regular extension of the diaphyseal bone band toward the epiphyses did not occur in the radius. Instead, ossification proceeded irregularly with secondary centers appearing in regions somewhat removed from the edge of the band. Fusion of all centers ultimately occurred.

Primary ossification centers of the component parts of the leg appeared as follows: femur, tibia, 8; second, third, and fourth metatarsals, 9; fibula, 10; astragalus and first metatarsal, 14; various parts of the phalanges, 11 to 15; distal tarsal, 19. Contrary to frequent statements that no independent epiphyseal centers of ossification occur in the long bones of birds, two such centers appeared in the distal epiphysis of the tibia in 19-day embryos.

46. Heteroplastic transplantation of embryonic duck kidney tissue to the just-hatched chick. Carl J. Sandstrom, New York University.

Subcutaneous transplantations of metanephric tissue from duck embryos 9, 13, 21, and 24 days' incubation were made to chicks which had just hatched. The transplants were not allowed to grow longer than 8 days. Regardless of the age of the donor, a large nodule formed which, upon examination, proved to be a tumor-like mass of connective tissue and either degenerate or necrotic donor tissue. In none of the grafts was normal metanephric tissue present on the eighth day, although some differentiation of the younger donor tissues took place just after implantation. In certain grafts (donors 9 and 24 days' incubation) the tubules retained their form, while in the others they were completely disorganized. There was an early infiltration of connective tissue, followed, in grafts of 21- and 24-day donors, by the formation of a thick, fibrous connective tissue capsule which apparently caused necrosis of the enclosed tissue. Lymphocytes, generally common in all the grafts, were abundant about the periphery of these necrotic areas.

Since identically aged metanephric tissue, especially that of 9 and 13 days' incubation, was found to grow normally on the chick chorio-allantois until the day before hatching (previously reported), the results suggest the possibility of the development of a defensive mechanism at the time of hatching as postulated by Murphy. More than likely, however, the reactions are local, and therefore, independent of the conditions in the chorio-allantoic membrane.

ENDOCRINOLOGY

Read

47. THE ALTERED THYROID GLANDS OF URODELE LARVAE DEVELOPING WITH ADDITIONAL EMBRYONIC PITUITARY TRANSPLANTS. Raymond F. Blount, University of Minnesota. (Introduced by D. E. Minnich.) (Lantern; 15 min.)

We have shown previously that Ambystoma larvae which have received transplants of additional pituitary anlagen during the embryonic period (triple pituitary animals) have increased pigmentation, decreased growth, altered body proportions and other changes.

The thyroid glands show a changed quantitative relationship between the colloid and the epithelium of the follicles. The volume of these has been determined by the paper cut-out method. While in the control animals examined the colloid is from 35 to 58 per cent of the follicular material of the gland, in the triple pituitary animals it is from 45 to 77 per cent. If expressed in respect to each animal's individual control there is an increase ranging from 5 per cent in a poor case to 66 per cent in an extreme case. The hypophysectomized donors show a decrease in colloid of from 34 to 66 per cent.

In extreme cases the colloid of the triple pituitary animals has greatly distended the follicle so that it appears not to be completely covered by epithelial cells although there is a very thin layer of cytoplasm present. The cells, other than the ones greatly thinned, are apparently not reduced in size but are pushed to one side and appear as a cap at one pole of the follicle.

These changes are interpreted as a stimulation by the excess pituitary tissue. The question arises as to how much of the alteration in growth of these animals is due to the pituitary acting through the thyroid.

48. THE THYROID GLANDS OF HYPOPHYSECTOMIZED NEWTS AFTER TREATMENT WITH ANTERIOR PITUITARY, THYROID AND IODINE. A. Elizabeth Adams and Beatrice Gray, Mount Holyoke College. (Lantern; 6 min.)

Newts hypophysectomized for 6 to 12 weeks were treated with anterior pituitary (grafts or injections of a mammalian extract), thyroid (grafts or injections of thyroxin) or iodine (crystals or injections of iodine solution). Muscle transplants or salt solution injections served as controls. The cornified layers of skin that accumulate after hypophysectomy can be caused to molt by any of the first three treatments, but not by the last two. Following the molting, the thyroids were fixed and studied. Anterior pituitary activates the thyroid, but thyroxin and iodine administration leave it in the inactive condition characteristic of the untreated hypophysectomized newt or of ones receiving muscle or salt treatment, so that their ability to set in motion the molting mechanism must be a direct one and not mediated by the thyroid. The failure of the thyroid of the hypophysectomized newt to react to thyroid treatment is to be expected since the gland is already in a resting condition and thyroid treatment inactivates the thyroid of normal animals. The lack of response of the thyroid of the hypophysectomized newt to iodine, however, points to the control that the anterior pituitary exercises on the thyroid's ability to utilize iodine, since in the normal animal iodine treatment activates the thyroid.

49. The response of thyroids of hypophysectomized newts to injections of phyone and their reaction after cessation of treatment. A Elizabeth Adams and Florence Martindale, Mount Holyoke College. (Lantern; 9 min.)

Injections of 0.2 cc. of a 0.1 per cent dilution of phyone (bovine anterior pituitary extract of Van Dyke and Wallen-Lawrence, '30) were given daily for 10, 20 and 30 days to newts (Triturus viridescens) that had been hypophysectomized for 5 weeks. At the end of the injection period, one thyroid was removed and fixed and the other allowed to remain in the animal for periods varying from 1 day to 5 weeks when it was removed and fixed. The volume of one gland typical of a normal animal and of ones typical of certain of the experimental animals was determined.

It was found that the injections stimulated the thyroids to and beyond the normal condition. The amount of stimulation increased up to 20 days, the cells enlarging in size and number and the supply of stored colloid being nearly depleted, but the response at 30 days was no greater or even less than that at 20 days. After injections ceased, the gland returned gradually to a condition very closely approximating the original, although it tends to be somewhat larger due to the hyperplasia that occurred during treatment. The rapidity and completeness of the return is somewhat dependent on the duration of the injection period. At 35 days, the 10-day stimulated gland resembles that of an untreated hypophysectomized animal, while the 20-day stimulated one appears similar to that of a normal animal.

50. The effect of adrenalectomy on blood cholesterol. E. W. Blanchard, Bryn Mawr College and Cold Spring Harbor Biological Laboratory. (Lantern; 10 min.)

In this study total, free, and combined cholesterol were determined in heparinized whole blood and plasma by the method of Schoenheimer and Sperry. Cats were used as the experimental animals, and blood was taken for analysis before operation, following unilateral adrenalectomy, and after the removal of the second gland.

Following unilateral adrenalectomy there may be no change, or a slight decrease or increase in total cholesterol. The proportional distribution between combined and free, and between plasma and cells remains normal. After the removal of the second gland varying results were obtained. The total cholesterol may remain practically unchanged, or increase or decrease slightly or markedly, during the life of the animal. The significant change in the blood cholesterol is its distribution between plasma and cells. Following complete adrenalectomy there are marked changes in the cholesterol partition. The blood cells become increasingly rich in cholesterol, both absolutely and in relation to the cholesterol content of the plasma. This is not a terminal change, but begins soon after the removal of the second gland, before the onset of any visible symptoms of adrenal insufficiency. This shift in cholesterol would seem to be significant when the role of the lipides in cell and membrane permeability is considered. If such a lipide shift occurs in other cells closely allied with the blood circulation, vis., blood vessels and capillaries, a possible mechanism might be found which would explain the reported loss of fluid from the blood to the tissues.

51. The use of vagina and uterine grafts to demonstrate the endocrine function of ovarian grafts in males. Carroll A. Pfeiffer, New York Hospital and Cornell University Medical College. (Introduced by C. V. Morrill.) (Lantern; 10 min.)

The uterine endometrium grafted into the eye of the normal female rat responds by hyperemia during the oestral period. The characteristic alternate blanching and flushing described in other species was not observed during the dioestral stage. In the normal or castrated male rat carrying an ovarian graft, the uterine endometrial graft does not show a cyclic change. No method of observation, with high enough magnification, has been devised in order to determine if there is any cyclic change in the epithelium of the intact vaginal graft in the eye of either males or females. However upon sectioning the ovarian and vaginal grafts in the male, whether normal or castrated after puberty, it is found that the ovaries contain only follicles and the vaginal epithelium is keratinized. These facts demonstrate that the ovary, under the influence of a male hypophysis, is noncyclic in action and that the oestrin level, while constant, is lower than that observed at oestrus under the influence of the female hypophysis.

52. Synergistic action of pregnancy urine and pregnant mare serum extracts on young guinea pig ovaries. S. L. Leonard and O. L. Leonard, Union College. (Introduced by James W. Mavor.) (Lantern; 15 min.)

Pregnancy urine and pregnancy mare serum extracts were injected separately and together into young female guinea pigs. The resulting increase in weight of the ovaries of the animals receiving both hormones was greater than the sum of the increases produced by each hormone alone to varying extents. A similar result was obtained by using follicle stimulating hormone instead of pregnant mare serum. The synergistic action of sex stimulating hormones has been previously shown in the rat but not successfully with the first combination of extracts.

The effect of pregnancy urine on the ovaries was to produce swelling of the interstitial cells, thecal luteinization, and pseudo-lutein bodies as described by others. The pregnancy mare serum extract produced effects similar to those of pregnancy urine but in addition, in several cases, large follicles and corpora lutea involving granulosa cells. The follicle stimulating hormone enlarged the follicles without inducing any other noticeable change in the ovaries. The results of the combined injections were like those obtained by pregnancy urine alone except that many small and medium-sized follicles were also present. Whether or not granulosa cells entered into the formation of the lutein bodies when the combined hormones were given cannot be definitely stated. The explanation for the synergistic action of these hormones in the guinea pig does not coincide with that in the rat.

53. Graafian follicle growth and oestrus in the guinea pig. Hugh I. Myers, William C. Young and Edward W. Dempsey, Brown University. (Lantern; 15 min.)

The graafian follicles in the ovaries of ninety-one sexually mature guinea pigs killed at eleven different stages in the reproductive cycle were studied in an effort to find a morphological change that coincides with the beginning of oestrus (sexual receptivity).

The entire dioestrum has been found to be a period of slow follicular growth and development. By the twelfth day the follicles show the beginning of a differentiation into two groups, one group of fifteen to twenty from which the follicles that are destined to rupture develop, and a much larger group that have begun to become atretic. But not even the follicles that will rupture show any significant increase in the rate of growth until oestrus begins. At this time a sudden enlargement occurs which culminates in ovulation about the end of oestrus. It is the beginning of this pre-ovulatory enlargement that coincides with the beginning of oestrus.

For some reason, though, the course of oestrus is not paralleled by the course of follicular development. On the contrary, the relationship is inverse, oestrus-intensity decreasing from an initial peak as follicle-size increases toward a maximum.

We believe this latter relationship will be found to be explained by the action of an extra-ovarian hormone in association with theelin in the production of oestrus. The possibility that a clue to the identification of this factor may be given by the discovery that the beginning of the pre-ovulatory enlargement coincides with the beginning of oestrus is now being investigated.

54. GONAD HORMONE EFFECTS IN NORMAL, SPAYED AND HYPOPHYSECTOMIZED RATS. Warren O. Nelson, Yale University. (Lantern; 15 min.)

Injection of 40 R.U. oestrone daily in normal females induces a type of pseudo-pregnancy in which large corpora lutea are formed and many luteal effects induced. Continuous diestrus, vaginal mucification, characteristic uterine effects, marked lobule proliferation of the mammary glands, enlargement of the hypophysis with chromophilic degranulation, and adrenal enlargement were noted. These effects did not occur regularly with 20 R.U. oestrone. In animals continued on injections over 20 days they began to disappear, the corpora lutea degenerated, and oestrus was continuous.

Forty R.U. daily in spayed females caused continuous oestrus with typical uterine and vaginal effects. Mammary glands showed definite lobule proliferation, but somewhat less than in intact animals. Pituitary castration changes were prevented, but weight increase and chromophilic degranulation were less marked than in intact animals. No adrenal hypertrophy was observed.

Hypophysectomized females receiving identical treatment showed vaginal and uterine effects like spayed animals. The ovaries contained persistent, but small, corpora. Mammary proliferation was erratic, but in general much less marked than in spayed animals. Adrenals resembled those of hypophysectomized controls.

Injection of progesterone ($\frac{1}{2}$ to 1 rabbit unit daily with the oestrone in spayed and hypophysectomized animals brought about vaginal and uterine conditions resembling those seen with oestrone only in normal animals. The mammary glands underwent some additional proliferation in spayed and in some hypophysectomized animals.

Probably these experiments find their explanation on the basis of an oestrone stimulation of luteinizing hormone release from the hypophysis. In cases where both hypophyses and ovaries were present characteristic luteal effects were induced.

55. The effect of hebin upon the reproductive system of the chick embryo. L. V. Domm and E. A. Dennis, The University of Chicago. (Lantern; 15 min.)

Single and repeated injections of hebin were made into the albumen of incubating eggs. Volume injected varied from 0.05 to 0.3 cc. and dosage from 5 to 30 R.U. Injections were made at varying ages, daily or on alternate days, the earliest beginning at 48 hours and majority terminating on ninth day. Development was allowed to continue until eighteenth day when surviving embryos were killed. Brown Leghorns and a variety with sex-linked plumage were used.

Mortality increased with increasing number of injections and with increase in volume of single injections but decreased with age. Viability was greater in hybrid variety than in Leghorn. Numerically, treated females were only slightly in excess of males.

Examination of females revealed hypertrophied gonads which, though variable, was especially noticeable with higher dosage. Particularly important was the striking response of rudimentary right gonad not previously encountered in our post-embryonic hebin injections. The male gonad likewise revealed hypertrophy though usually less pronounced than in the female. Müllerian and wolffian ducts revealed little if any response.

Sections of experimental ovaries studied show a narrow, irregular, discontinuous surface layer of cortex with medulla coming to the surface wherever cortical layer is broken. The medullary layer reveals considerable distention and it appears that hypertrophy of the ovary is due primarily to its growth. Sections of right rudimentary gonad reveal a condition very similar to that found in the medulla of left gonad with surface areas of cortex not infrequent.

56. Spontaneous sterility in the male rat. George K. Smelser, Columbia University. (Lantern; 15 min.)

In a pure Long-Evans strain of rats a number of adult males were discovered having aspermatic testes of from one-fifth to one-sixth the normal weight. The testes were small but firm and were not cryptorchids. The epididymes were small and aspermatic, though the accessories were large and distended with secretion. The body weight and general condition of these animals were normal; they mated readily, producing a vaginal plug and typical pseudopregnancy in the test females. Autopsies revealed normal adrenals and thyroids both grossly and microscopically. The pituitaries, approximately normal in weight, were filled with castration cells and enlarged basophiles.

Histological examination of the testes showed apparently normal interstitial cells and tubules containing only Sertoli cells. There was no evidence of spermatogenesis, even the characteristic nuclei of the spermatogonia were absent. One case showed five or six spermatogonia.

Several of these rats were unilaterally castrated to obtain a control. Each was treated for approximately 1 month with one of the following gonadotropic materials: Antuitrin S; an extract of castrate or menopause urine; a follicle stimulating fraction of anterior pituitary; daily implants of rat anterior pituitary. The antuitrin S caused a marked increase in accessory weight, but no cases of spermatogenesis resulted from the varied treatments.

Breeding records showed these animals to be closely related. A few sterile males have been produced, by breeding the normal litter mates of the animals, in a proportion that could be explained by mendelian inheritance.

57. Effects of simultaneous oestrin-corpörin treatment on the uterus, cervix, vagina and sex skin of castrated monkeys. Frederick L. Hisaw, Harvard University. (Lantern; 15 min.)

Ten castrated, adolescent, Macacus rhesus monkeys were given daily injections of oestrin and corporin, combined in varying amounts, for 10 to 59 days and the effects on the uterus, cervix, vagina and sexual skin were studied.

The uteri of monkeys receiving such treatment for longer than 10 to 15 days were very much larger than those given oestrin or corporin alone. The endometria were in a fully developed premenstrual condition and the glands showed different degrees of secretory exhaustion depending upon the length of treatment. Corporin alone, following an oestrin treatment, does not materially increase the size of the uterus.

Six uteri were traumatized either by biopsy or threads from 8 to 10 days after beginning the combination treatment. Endometrial proliferation characteristic of normal implantation sites occurred in all cases. Such proliferations apparently originate from the surface and glandular epithelium and giant cells and multinucleated cell masses are common. These proliferated cells undergo vacuolation, degenerate and disappear if treatment is continued longer than about 15 days.

Squamous metaplasia in the cervical glands follows oestrin treatment. These precancerous-like structures do not develop on oestrin-corporin combinations and if present, as a result of previous oestrin treatment, will disappear. Once formed, they will also disappear after discontinuing oestrin treatment.

The heavily cornified condition of the vaginal epithelium, characteristic of oestrin action, decreases on oestrin-corporin combinations and may be entirely lacking if the treatment is prolonged. The sexual skin loses its oedema and fades on oestrin-corporin combinations.

58. Influence of estrogenic hormones on the pelvis of the mouse. W. U. Gardner, Yale University School of Medicine. (Introduced by Edgar Allen.) (Lantern and moving pictures; 15 min.)

A dimorphism has been observed in the pelves of certain rodents (guinea pig and pocket gopher) which has been associated with ovarian function and reproductive activity (Hisaw, '25 and '29). A pelvic dimorphism associated with gonadal and reproductive influences also exists in the mouse.

The pelves of young male and female mice are similar. In mature virgin female mice and in male mice bearing ovarian grafts the pubic bones are reduced in size. They remain firmly united at the symphyses by a fibrous or a fibrocartilage union. During pregnancy the pubic bones become separated at the symphysis, a connection by a ligamentous band remaining. This change is not reversible and is progressive with an increased number of pregnancies.

Injection of 10 r.u. per day of water soluble theelin will induce a thinning of the pubic bones in young males, but will not induce a separation of the pubes. Pelvic changes comparable to those observed in triparous females have been induced in male mice receiving 500 i.u. of folliculin benzoate weekly. When the injections are started at birth the distal ends of the pubic and ischial bones do not ossify.

These changes in the pelves of male mice are associated with the formation of scrotal hernias and probably with urine retention. An atypical growth of the mammary glands and of the seminal vesicles was observed in the mice receiving the larger doses.

59. Ovulation. Edgar Allen, R. T. Hill and H. S. Burr, Yale University School of Medicine. (Lantern and moving pictures; 15 min.)

Following Walton and Hammonds' observations of ovulation in the rabbit, successful motion pictures have been made of this process (Hill, Allen, Kramer, Anat. Rec., in press). Ovulation was induced by mating stimuli, the animal anesthetized, and one ovary immersed in physiological saline in a closed chamber. As ovulation time approached, the enlarging follicles were photographed by both reflected and direct light, in both profile and surface views. Actual rupture of the follicle seems to be almost explosive in nature. After ovulation the extruded ovum still attached to the ruptured follicle, and ciliary action of the tube, a primary factor in transport of the ovum to the uterus, are shown.

Using an extremely sensitive potentiometer, it has been possible to record striking changes in electrical potential coincident with ovulation in the intact and deeply anesthetized animal (Burr, Hill Allen, Proc. Soc. Exp. Biol. and Med., in press). A rise in electrical potential precedes, and a sharp fall to the base line immediately follows, rupture of each follicle. The time of ovulation and the number of follicles ruptured may thus be recorded.

60. Effects of follicle stimulating and luteinizing hormones on the testicles and accessories of normal and hypophysectomized rats. Roy O. Greep, Harvard University. (Lantern; 15 min.)

The testicles of hypophysectomized or normal immature male rats undergo enlargement as a result of either FSH or LH treatment. The histological character of the testicular response to these two hormones is quite different, and is especially well defined in the gonads of pituitaryless animals. The FSH causes rapid proliferation of the seminiferous epithelium but the interstitial cells are not effected. Contrawise, LH stimulates little if any proliferative activity in the tubules whereas the interstitial cells are greatly increased in size and apparently in number.

The accessory male structures such as the seminal vesicles and prostate show no increase in size when FSH is given but respond very markedly to LH. Hypertrophy of the external genitalia, priapism and spontaneous ejaculations are also features of LH action. The unchanged state of the accessories in the presence of tubular stimulation from FSH action coupled with the constant stimulation of accessory sex structures whenever LH was given, points to the hypertrophied interstitial tissue as the source of male hormone.

61. The effect of fractionated and unfractionated gonadotropic preparations on testes and comb growth in the chick. W. R. Breneman, Miami University. (Lantern; 15 min.)

Sex linked chicks from a Barred Plymouth Rock and Rhode Island Red cross were injected subcutaneously with preparations frog hog anterior pituitary lobe and pregnant mare serum. Experiments began on the fifth day after hatching and ran 10 days. The testes gave a definite qualitative response to the fractionated extracts: the follicle stimulating hormone (F.S.H.) produced only an hypertrophy of the seminiferous tubules; and the luteinizing fraction (L.H.) stimulated the development of the interstitial tissue. Injections of whole (unfractionated) anterior pituitary extract, F.S.H. and L.H. after combination in vitro, and pregnant mare serum were followed by the hypertrophy of both the seminiferous tubules and the interstitial cell mass. Maximum development of the tubules followed after F.S.H. was injected alone. At the dosage used, mare's serum gave the maximum weight increase.

Comb growth was directly correlated with the degree of development of the seminiferous tubules. No appreciable increase was observed in those birds which received the L.H. preparation, and although the gonad weight was greatest in the mare-serum group, the comb growth was less than that of the chicks which were given F.S.H.

62. Augmentation of the gonad stimulating action of pituitary extracts by yeast extracts and by copper salts. H. L. Fevold, Harvard University. (Introduced by Alfred C. Redfield.) (Lantern; 15 min.)

Aqueous pyridine extracts of acetone dried yeast have no effect on the ovarian weight of immature rats when injected alone. When such extracts are combined with gonad stimulating preparations from pituitary powder (F.S.H. or FSH + LH) they augment the gonadotropic action. The character of the response is not altered but quantitatively it is increased markedly. The yeast extracts, when injected intravenously in female rabbits in oestrus, produce ovulation and the formation of blood follicles. They also produce enlargement of the testes of immature male pigeons.

The ash obtained by ignition of the yeast is equally as active in augmenting the action of pituitary gonadotropic preparations as the yeast extract. It does not produce ovulation in rabbits nor does it have any effect on the testes of pigeons.

Copper salts were found to be one of the constituents of the yeast ash. Therefore the effect of pure copper salts on the ovarian response to gonad stimulating preparations was investigated. Copper chloride, copper sulfate and copper acetate produce a very marked increase in ovarian response to FSH and unfractionated pituitary extracts. Iron manganese, aluminum and nickle salts are without effect. Zinc salts have an effect but not as great as that of copper. None of these salts alter the character of the ovarian response.

CELLULAR PHYSIOLOGY

Read

63. Cleavage of non-nucleated fragments of Arbacia eggs. Ethel B. Harvey, Princeton University. (15 min.)

The pigmented halves of Arbacia eggs, obtained by pulling apart the whole eggs by centrifugal force, serve as the material used in this study. Since the nucleus invariably goes to the lighter pole of the egg, the heavier red halves never have nuclei. Enucleate quarter eggs have also been used, obtained by further centrifuging of the red halves which pull apart into yolk quarters and pigment quarters.

When these enucleate halves and quarters are treated with parthenogenetic agents such as concentrated sea water, they throw off fertilization membranes. When transferred to sea water, cytasters appear in the eggs after about an hour, and after 2 or 3 hours cleavage planes come in. I have observed in many living fragments, especially in the yolk quarters, a large monaster, followed by an amphiaster, and this later by a cleavage plane between the two asters in quite typical form. By subsequent cleavages, three, four, five and many cells are formed, sometimes equal, sometimes unequal. Blastulae of 100 or more cells have developed from these non-nucleate fragments, quite normal in appearance, but as yet no swimmers.

The cleavages of these artificially activated enucleate halves and quarters resemble in every way (in the living material) those occurring in similar fertilized halves and quarters in whole eggs (with nuclei) centrifuged and then fertilized, except that they occur much more slowly and there are no nuclei visible during the resting stages. They are also similar to those occurring in whole and half eggs, nucleated, activated by parthenogenetic agents.

64. Localization of peptidase activity in marine eggs. Heinz Holter, Washington Square College, New York University. (Introduced by Ruth B. Howland.) (Lantern; 15 min.)

Using the enzymatic micromethods developed by Linderstrøm-Lang and the author, an attempt was made to establish a quantitative correlation between the distribution of cytoplasmic constituents of eggs and their peptidase activity (substrate alanylglycine).

Arbacia eggs were stratified and separated into two halves by centrifuging, the halves containing different layers of the formed bodies (mitochondria, yolk, etc.). Ten eggs or egg halves were used in each determination. It was found that the activity was unequally distributed, the centripetal half being three to four times as active as the centrifugal one. Since both halves showed enzymatic activity, all cytoplasmic constituents contained in one-half only could be ruled out as bearers of the enzyme. Of the cytoplasmic constituents contained in both halves, only the hyaline plasma (matrix) showed a distribution similar to that of peptidase activity.

The volume of the hyaline plasma or matrix material was taken as equal to the total volume minus the volume of the formed bodies (measured by E. N. Harvey), in every case the ratio of matrix volumes for the two egg halves agreed within 10 per cent with the corresponding ratio of peptidase activity.

The same relation holds true for the eggs of Echinarachnius. In this case, determinations could be made on single eggs or egg parts. The egg parts were secured by cutting stratified and elongated eggs on the micromanipulator. By this method it was possible to vary the distribution of egg constituents arbitrarily.

The ratio of total volumes for the upper and lower parts of the cut eggs was varied from 0.4 to 2.7, corresponding to a variation in the ratio of matrix volumes of 0.45 to 49. In every case the ratio of peptidase activities and of matrix volumes agreed within 10 per cent.

It is concluded, therefore, that peptidase is diffusely distributed, and is probably dissolved in the hyaline plasma or matrix of egg cytoplasm.

65. The relation between the sperm-aster and the first-cleavage figure in Arbacia eggs. Henry J. Fry, Cornell University Medical College. (Lantern; 15 min.)

The manner in which the sperm-aster gives place to the first-cleavage figure in Arbacia eggs cannot be determined from studies of the living eggs, because details of asteral structure are invisible there, although the general configurations of the asters can be vaguely seen. Even in fixed cells the study of the origin of the cleavage figure is difficult, because, first, the time when the sperm-aster disappears is also the time at which the cleavage-asters arise; and second, under ordinary conditions of fixation, the rays of both sperm-aster and cleavage-asters are fixed so delicately that it is difficult to determine their relationships.

Hence Arbacia eggs were subjected to various experimental techniques, including the use of low temperature, dinitro-o-cresol solutions, ether, and dilute fixatives. These experiments indicate that the sperm-aster does not divide to form the cleavage-asters, but that the latter arise de novo. Low temperature, 7.5°C. completely suppresses the sperm-aster, but does not interfere with the formation of the normal cleavage figure; here the cleavage figure cannot arise by the division of the sperm-aster. The other techniques coarsen the rays sufficiently to indicate that the cleavage-asters arise de novo, and not by the division of the old sperm-aster.

This result is in harmony with the fact that asters in general do not divide, but arise de novo.

66. Oxygen uptake of cell fragments obtained by centrifuging the egg of the sea urchin, Arbacia punctulata. Herbert Shapiro, Princeton University. (Introduced by E. Newton Harvey.) (Lantern; 10 min.)

Recent studies on the physical properties and experimental embryogeny of cell fragments have led to an investigation of a physiological aspect of these cells. The respiration of fertilized and of unfertilized fragments of the egg of the sea urchin, Arbacia punctulata, obtained by breaking whole eggs by centrifugal force, was measured by the Warburg constant volume manometer and with the Fenn-Winterstein volumeter. The unfertilized light half, containing a nucleus, but devoid of pigment, consumed oxygen at approximately the same rate as the whole cell, while the unfertilized pigmented half, without a nucleus, but possessing most of the yolk and echinochrome, displayed an oxygen uptake 88 per cent in excess of that of the whole egg. The combined activity, in this respect, of the two

halves was greater (29 per cent) than that of the whole egg. On fertilization, the light halves showed a 2.7-fold increase (at 25.9°C.) which was similar to the behavior of whole cells, where as the pigmented halves upon activation did not display any significant change in their already high oxygen uptake. The sum of the respiratory rates of the two kinds of fertilized halves, when combined as above, on the basis of relative volume, to the volume of the whole egg, was 17 per cent less than that of the whole fertilized egg. The results are in accord, qualitatively, with those of Navez and Harvey on the indophenol oxidase activity of fragments. If respiration of Arbacia fragments be ascribed only to the granule-free portion of the cell, the disparity between light and heavy unfertilized fragments becomes still further accentuated.

67. Nuclear movements in the developing Drosophila egg. Alfred F. Huettner, Washington Square College, New York University. (Lantern; 15 min.)

There are three types of movement of the nuclei in the developing Drosophila egg. 1) Movement of cleavage nuclei from the first to the eighth cleavage, resulting in the even distribution of 256 nuclei throughout the entire egg. 2) Movement of cleavage nuclei into the cortical ooplasm during blastoderm formation. 3) Movement of nuclei located in the posterior region of the egg in the formation of the germ cells.

The first type of movement is partially conditioned by the mitotic spindle. However, other factors must be involved, since nuclei continue to move slightly when the spindle has disappeared.

No explanation can be offered for the second type of movement. The possibility of protoplasmic streaming must be excluded because some of the cleavage nuclei remain behind (yolk nuclei) when all the others have moved into the peripheral ooplasm.

The third movement is probably due to a combination of spindle action and protoplasmic flow.

68. A physical property of the plasma membrane. Robert Chambers, Washington Square College, New York University. (Cinema; 10 min.)

A peculiar phenomenon of the protoplasmic surface has been demonstrated by the intimate contact it makes with a droplet of oil which is brought against it. This was shown to occur in the ameba (Dawson and Belkin) in the protoplast of onion bulb cells (Chambers and Hofler) and has been found also to occur in unfertilized marine eggs. In the last case the oil drop, many times smaller than the egg, rapidly slips through the surface into the interior of the egg where it assumes a spheroidal contour against the internal substance of the egg and a flattened contour of that part of its surface in contact with the inner surface of the plasma membrane to which it adheres.

The droplet cannot be pulled away completely from the inner surface of the plasma membrane. In attempting to do this the oil drop may break in two, one portion instantly becoming a free, spherical droplet floating in the interior of the egg while the other portion remains a diminutive replica of the original droplet with a flattened surface against the plasma membrane. This surface of contact appears to be liquid since the droplet can be made to slip along the inner side of the surface of the egg.

COMPARATIVE AND GENERAL PHYSIOLOGY

Read

69. Effects of various periods of starvation on growth, reproduction and longevity in Cladocera. Lester Ingle, Brown University. (Introduced by A. M. Banta.) (Lantern; 15 min.)

As previously reported, Cladocera when maintained in highly dilute medium, release smaller broods of young and grow more slowly, but live considerably longer than animals which are kept in normal medium.

The present experiments were designed to determine the effects of various periods of starvation on growth, reproduction and longevity. Six groups of D. longispina were observed twice daily throughout life: 1) forty-nine well fed throughout life, 2) sixty-seven starved until the sixth instar, 3) seventy-two starved until the ninth instar, 4) seventy-six starved until the twelfth instar, 5) fifty-seven starved until the fifteenth instar, and 6) forty starved throughout life. Animals of groups 2 to 5, inclusive, were transferred at the end of their starvation periods to normal medium, hence were well fed during the remainder of their lives.

Average longevity of the different groups was 28.75, 36.5, 41.75, 44.0, 51.19 and 40 days, respectively. The animals grew very slowly while on the starvation diet, but when transferred to an abundance of food grew rapidly and finally attained a maximum body length which approximated that of group 1 (2.97 mm.). The reproductive rate was low during starvation but increased rapidly after transfer to normal medium.

Animals which grow slowly, especially during the earlier part of life, and have a low reproductive rate because of food scarcity live longer than those which are well fed, grow rapidly and exhibit a high rate of reproduction. Those starved until the twelfth or fifteenth instar (when growth is normally about completed) have a greater longevity than those starved throughout life.

70. Osmotic exchanges of Phascolosoma. Edward F. Adolph, University of Rochester. (Lantern; 10 min.)

The objectives were: to measure the rates of water transfer through the body wall; to find whether the permeability could be altered; and to discover any active regulation of water or electrolyte content. Worms of 1 to 11 gm., kept at 20° to 26°C., were weighed at intervals.

The times required for entrance of water from diluted sea water were much less than for exit to concentrated sea water. Body size and area of immersion also influenced rates of osmosis. Body weights at equilibrium indicated original non-solvent contents of 12 to 30 per cent, the dry matter being 12 per cent. Upon return to normal sea water, entrance was again faster, and the original body volumes were accurately reattained. The effects of various electrolyte and non-electrolyte solutions did not differ from those of sea water, except when organic solutes penetrated the body.

When solutions were injected into the body cavity, sufficient water was exchanged to make the inner fluids isotonic, except in the cases of non-electrolytes that were not retained. After the initial exchanges, material that was injected, even body

fluid, was slowly lost. If body fluid were removed, weight very gradually increased. Evidently these were changes of body volume rather than of concentration of any known constituent.

It is concluded: that rates of water transfer in one direction are proportional to gradients of osmotic pressure; that no electrolytes pass through the body wall, except possibly extremely slowly or by exchange of ions; and that after injections, body volume regulates slowly toward normal.

71. The gaseous metabolism and changes in chemical composition of the blow fly, Phormia regina (Meigen), during pupation. F. A. Hitchcock and J. G. Haub, Ohio State University. (Introduced by W. M. Barrows.) (Lantern; 15 min.)

During pupation the O_2 consumption of the blow fly drops from 3.5 cc. to 0.65 cc. per minute per 100 gm. Before emergence it rises to about 2.0 cc. per minute per 100 gm. The pupae give off NH_3 as well as CO_2. Measurement of the amount of NH_3 excreted makes possible an estimation of the protein metabolism. The R.Q. fluctuates around a mean value of about 0.70, but there are definite periods in which it drops to 0.65 or lower.

The chemical composition has been determined by direct analysis and by the combustion of the dried organisms in a modified oxy-calorimeter. Both methods show a progressive decrease in fat and an increase in carbohydrates as pupation advances. The carbohydrate content of the flies is about twice that of the larvae. The loss in protein is insufficient to account for all of this increase and we have computed that part of it must result from the conversion of fat to carbohydrate. This is the first time that such a process has been demonstrated in an animal organism.

One hundred grams of maggots produce about 64 gm. of flies and in the process consume about 11 liters of O_2. From these figures we compute that one maggot uses up in the process of metamorphosis about 7 cc. of O_2 and liberates about 33 gm. calories of heat.

72. The heat production of pupae of Galleria mellonella throughout development. Frederick Crescitelli and Ivon R. Taylor, Brown University. (Lantern; 15 min.)

Using animals of both sexes individually, the rates of heat production throughout pupal development have been measured at frequent periodic intervals at 30°C. The measurements were alternated with manometric measurements of rates of oxygen consumption and the calorific quotients were calculated. The rates of heat production range from approximately 1 to 7 gm. calories per gram of animal per hour and parallel those of oxygen consumption, the resulting curves in both cases being of the U-shaped type with a terminal drop. In agreement with results reported by Taylor and Steinbach ('31) and Crescitelli ('35), a sex difference was found in the rates of oxygen consumption. A strikingly similar sex difference was obtained in the rates of heat production. The males exhibit somewhat higher rates of heat liberation during the greater part of pupal life but toward the end of this period the females possess the higher rates. The average values of the calorific quotient vary between 1.16 and 2.84, the lowest

values being obtained at the time when the rate of heat production is at a minimum. Such relatively low values are in general agreement with the results of Balzam ('33) for pupae of Lymantria dispar and Bombyx mori.

73. The Oxygen consumption of Hexagenia recurvata during the winter and early spring. A. H. Morgan and J. F. Wilder, Mount Holyoke College. (Lantern; 12 min.)

The immature stages of the mayfly, Hexagenia recurvata, are nymphs which live in the water for about 2 years before emergence. Their winter behavior was studied in their habitat and in the laboratory. The oxygen consumption of nymphs collected within 24 hours and those kept in the laboratory 10 days or more was measured at regular intervals through the winter and spring. Nymphs kept in the laboratory consumed less oxygen than recently collected ones.

From December 1st through January 13th the oxygen consumption was less than in the later winter period, January 29th through March 17th. In the earlier period the lowered metabolism was indicated by absence of molting, and by resistance to unfavorable conditions. In the later period, the heightened metabolism was shown by greater mortality. There also seemed to be some evidence of more positive response to light. All of this occurred before there was any rise in the temperature of the water in their natural habitat or in the laboratory. In experimentally varied temperatures the oxygen consumption was directly proportional to the rise or fall in temperature.

The observations indicate that there is a winter rhythm in Hexagenia recurvata which is modified by, but not dependent upon temperature. The early winter 'low' in the oxygen consumption and metabolism of these nymphs suggests a period somewhat similar to the hibernation of other insects.

74. Quantitative studies on the respiration of Arthropods and on the permeability of their outer integument to gases, water and electrolytes. N. S. Royston Maloeuf, Cornell University. (Introduced by H. D. Reed.) (10 min.)

Neither crayfish nor dragonfly larvae secrete oxygen at any time into the external medium. This is in contradiction to the work of Helff who used the unmodified Winkler titration and water deaerated by the animals themselves. I used a special respirometer from which samples could be introduced into the Van Slyke-Neill gasometric apparatus under a mercury seal. The crayfish (Cambarus bartoni) and the dragonfly larvae (Anax junius) have a respiratory rate that is more or less dependent on the oxygen tension of the medium. Both are capable of some anaerobic metabolism which is evidenced as a rise in the respiratory quotient well above unity as the oxygen tension of the outside medium reaches low levels. The crayfish are capable of a fairly protracted purely anaerobic metabolism from which they may recover; the dragonfly larvae soon die after ceasing to consume oxygen. Both are capable of utilizing the last trace of analyzeable oxygen in the medium.

A special osmometer-conductance cell showed that the general integument of the crayfish is impermeable to water and electrolytes in both directions and that this impermeability is not a function of any living cells connected with the cuticle.

The gill filaments of the crayfish are permeable to water in both directions but impermeable to electrolytes in both directions. This condition is solely a function of the cuticle.

The crayfish can live indefinitely, and maintain vigor and a constant weight in an isotonic medium of pure sodium chloride. In a hypertonic medium it loses water through its gills, takes in the medium via its mouth and dies in about 10 hours in a salinity of 7 per cent.

75. Hemoglobin function in the developing chick. F. G. Hall, Duke University. (Lantern; 12 min.)

The affinity of hemoglobin for oxygen has been studied in chicks from the ninth day of incubation to maturity. There is progressive shift in the oxygen dissociation curve obtained from blood of chicks during incubation and early post-hatching development. It is suggested that there are at least two distinct forms of hemoglobin in the blood, one form being replaced by another during early growth of the individual.

76. The Influence of visible light on reorganization and regeneration in the polychaete Sabella. John Berrill, McGill University. (Introduced by E. G. Conklin.) (Lantern; 15 min.)

Regeneration can take place from the anterior cut surface of any segment of the body. It is limited to the formation of three segments only. New thoracic segments are formed as the result of a reorganization of abdominal segments immediately posterior to the regenerating segments. The number of segments reorganized, at all temperatures, remains virtually constant in the absence of light. In the presence of light above a certain threshold intensity the number of segments reorganized varies with the intensity. Yellow green light is effective, whereas ultraviolet and infra-red are not. The full effect of the light is obtained as readily when only the anterior regenerating segments are exposed to it. The reorganizing stimulus passes from the regenerating tissue into the old tissues and there is a definite summation of stimuli, so that a series may convert almost the whole of a worm from thoracic to abdominal structure. It is considered that there is present a true photochemical mechanism that reinforces a process that occurs in complete darkness, and that it is significant that even in the dark the temperature coefficient for effect is very close to unity.

77. Development of a secondary sexual character in the Crustacea. Hugh H. Darby, College of Physicians and Surgeons, Columbia University. (Lantern; 15 min.)

The development of the snap-claw in Crangon armillatus is shown to consist in the modification of the pinch-claw, a simple biramous appendage, by a sex hormone. High temperature enhances the production of this hormone. It has been possible to produce a Crangon, by the use of temperature, reversible effects comparable to those obtained in other animals by the administration of hormone preparations.

The time at which one claw is differentiated to become the modified appendage has been determined experimentally. It is an extremely small fraction of the intermolt period, hence this process is extremely rapid. The rate of growth of the two sides is shown to be unequal, in agreement with data previously reported.

The nature of the reorganization of the small unmodified claw is shown to be a remodeling of each part of the pinch-claw into its counterpart in the snap-claw. The seat of reorganization is at the tip of the pinch-claw. These two statements, based on physiological experiments, are confirmed by a study of the histological structure of the claws.

78. Further studies on the biological action of intense sonic vibration. Leslie A. Chambers, University of Pennsylvania. (Lantern; 15 min.)

Intense sonic vibration of suspensions of bacterial cells and protozoa produces in the organisms a series of observable events in definite sequence, viz., immobilization, imbibition and plasmolysis, coagulation, and, finally, disintegration. Once initiated the chain of events proceeds to completion with or without continued vibration.

Vibration under relatively high hydrostatic pressures has shown that the lethal effect of the sound waves is not dependent upon cavitation. The lethal reaction may be initiated in bacterial cells and in protozoa at pressures which inhibit the formation of cavities in the supporting medium.

Furthermore the series of phenomena preceding death may be initiated in protozoa at acoustic field densities too low to cause cavitation at normal pressures.

Since the lethal action is more rapid in the presence of cavitation it seems likely that two mechanisms are involved, one operative below the critical cavitation pressure, the other at higher pressures.

Where cavitation does occur the lethal action of sound may result directly from chemical changes within the cell or in the medium, since previous work has demonstrated that oxidations, hydrolyses, depolymerizations and denaturations may result from the vibration. However, no chemical system has been found to be affected by sonic vibration in absence of cavitation. Presumably the death of the organisms under such conditions results from a direct physical action of the sound waves.

79. Lethal periods for Paramecium in normal and polarized light of high intensity. Robert C. Miller and Vance Tartar, University of Washington. (Lantern; 10 min.)

This paper is a report on the length of time required to cause disintegration of Paramecium in normal and polarized light of (the same) lethal intensities. Carbon arcs were used as sources of light and Nicol prisms as polarizers. The light was equilibrated with a Weston cell and multimeter, and the temperature controlled within 0.5°C. with a cooling cell. Two species of Paramecium, P. caudatum and P. aurelia, were used. In each set of experiments the organisms irradiated were the offspring of a single individual. The results indicate conclusively that polarized light of high intensity is less lethal than normal light of the same intensity in the case of non-sensitized Paramecia. If the organisms are sensitized with eosin this differential disappears. Thus it appears that in the

death of eosin sensitized organisms the total luminous energy alone is of importance, while in non-sensitized organisms the question of polarization or non-polarization is involved.

80. The effect of x-rays on cleavage in Arbacia eggs: Evidence of nuclear control of division rate. Paul S. Henshaw, Memorial Hospital, New York City. (Lantern; 15 min.)

Experiments have been carried out to investigate the influence of x-rays on the division rate of Arbacia punctulata eggs. It was found, first, that the time required for the first cleavage was noticeably prolonged when the eggs were irradiated before fertilization. Second, it was found that the same effect could be produced by irradiating the sperm before they were allowed to fertilize normal eggs. Thus, an irradiation effect was carried by one fragment of protoplasm into another where the effect became expressed. The non-irradiated protoplasm was, therefore, caused to behave as though it had been irradiated. It is pointed out that only the nucleus and centrosome of the sperm appear to have an important influence on the egg and that the irradiation effect must have been carried by one or both of these. Reasons are given for believing that the centrosome was not important in this respect, thus indicating that the slowing of cell division observed was due to irradiation effects produced in the nucleus. It appears, therefore, that the nuclei of the cells studied exert at least some control over the rate of cell division. Further, it is significant that such control is manifested when the damage is produced in a haploid nucleus and that the effect becomes expressed in the presence of a normal haploid nucleus.

81. The effect of sulfur on the rate of respiration in Chilomonas paramecium. S. O. Mast, D. M. Pace and Louise R. Mast, Johns Hopkins University. (Lantern; 15 min.)

In earlier experiments we have demonstrated that if sulfur is omitted from the culture solution there is great accumulation of fat, ending in death, owing to what appears to be fatty degeneration. We concluded that the fat originates by the transformation of starch; that if sulfur is present in proper concentration, the fat oxidizes as rapidly as it is formed, but that if sulfur is not present, it does not oxidize and consequently accumulates.

We extended these experiments and, by means of manometers, made measurements concerning the correlation between concentration of sulfur, oxygen consumed and CO_2 produced.

In our best culture solution the consumption of oxygen is $0.15\pm$mm.^{3} per 10,000 individuals per hour, and the respiratory quotient is $0.3\pm$.

If sulfur is omitted, the consumption of oxygen and the fat content remain nearly normal for 6 to 8 hours; then the former decreases, reaching nearly zero in 24 hours, and the latter increases, resulting in great accumulation of fat in the body in 24 hours.

These facts strongly support the conclusion that sulfur functions in oxidation of fat.

If fat is oxidized the respiratory quotient should be around 0.7. The fact that it is only $0.3\pm$ shows that some of the carbon dioxide produced is used in synthesis, i.e., it shows that even in solutions containing acetate some carbon is obtained from carbon dioxide.

82. Animal and plant cells in mixed cultures. Ralph Buchsbaum, The University of Chicago. (Introduced by Sewall Wright.) (Lantern; 15 min.)

To keep tissue cells in vitro alive, tissue culturists renew the medium by subculturing or perfusion. If oxygen and food materials could be supplied and carbon dioxide and other wastes removed more efficiently, there should be an improvement in health of tissues in vitro. There are many animals which harbor green algae in symbiotic relationship. The algae presumably benefit by receiving carbon dioxide and nitrogenous substances from the animal; the animal cells supposedly benefit by receiving oxygen and carbohydrates (as by-products of photosynthesis) and having their waste products removed.

Aseptic cultures in plasma were made of unicellular algae, Chlorella sp., with embryonic chick tissues. In control cultures of algae alone, the growth was slow, the cells were pale, and the chloroplasts shrunken. In mixed cultures, the plant cells grew abundantly, they were larger, greener, and the chloroplasts were normal. As the tissue cells grew the plant and animal cells were intimately mixed. Many algae were taken up by macrophages and fibroblasts, and digestion probably occurred since enclosed algal cells could be seen in all stages of disintegration. The macrophages and fibroblasts were not fatty when the control cultures of tissue showed extreme fatty and granular degeneration. In rate of growth as determined by increase in surface area, the mixed cultures were far superior to the cultures of tissues alone.

Experiments are in progress to determine the mechanism of this apparent artificial symbiosis.

83. Periodicity and diurnal rhythm in the firefly, Photinus pyralis. John B. Buck, Johns Hopkins University. (Introduced by S. O. Mast.) (Lantern; 15 min.)

In nature males of Photinus pyralis ordinarily flash every evening between 7 and 9 P.M. The time of flashing is correlated with temperature and light intensity.

Males which have been in strong light flash immediately if the intensity is sufficiently reduced, regardless of the time of day, showing that the regular evening flashing period can be modified.

Males kept continuously in darkness do not flash. If, however, they are exposed to weak light they flash (regardless of the time of day) provided they have previously been in darkness 24, 48, 72 or 96 hours, but not if they have been in darkness 12, 36, 60 or 84 hours.

If males which have been in darkness less than 24 hours are exposed to weak light and left in it they do not flash until the sum of the time spent in darkness and the time spent in weak light is equal approximately to 24 hours.

It is thus clear that there exists in this firefly an inherent diurnal periodicity which is manifested by periods of flashing which recur at 24-hour intervals and which persists for at least 4 days in the uniform environment of the darkroom. It is also clear that, although in the field this periodicity coincides with the diurnal cycle of changes in light intensity, it is not actually linked to any specific hour of the day.

84. A COMPARISON OF MAZE BEHAVIOR IN PAIRED AND ISOLATED SHELL PARRAKEETS (MELOPSITTACUS UNDULATUS SHAW) IN A TWO-ALLEY PROBLEM BOX. W. C. Allee and R. H. Masure, The University of Chicago. (Lantern; 15 min.)

Both isolated and paired shell parrakeets show rapid improvement in speed of reaction and in reduction of errors with repeated experience in a simple two-alley problem box. With both, the period of most rapid improvement lasts for less than the first 10 to 12 days. The paired birds have a significantly slower reaction time and tend to make more errors; they also tend to give a more erratic performance, although the paired animals can become as well trained as those isolated. Parrakeets caged in pairs but trained alone show maze behavior like that of individuals caged and trained alone. When paired and isolated birds, well trained for a given signal, have their grouping reversed, the newly isolated birds show less disturbance than the newly paired individuals. When birds that have been trained to respond to one signal are rearranged, with the paired individuals isolated and vice versa, and trained to respond to a new signal, the change in signal appears to be more disturbing than the change in social relationship. These birds show marked retention of maze training, even after it had been discontinued for 6 to 8 months; during their absence from training they passed through a breeding period in an outdoor aviary. The two lots of birds whose training was continued into the spring months showed an unexplained disturbance in their reactions both when isolated and when paired; the latter were the more disturbed. There is no evidence that heterosexual pairs behave differently from homosexually paired parrakeets.

85. THE MANIPULATION OF HYDRA'S NEMATOCYSTS BY MICROSTOMUM. William A. Kepner, W. C. Gregory and R. J. Porter, University of Virginia. (Lantern; opaque projection; 15 min.)

The polyp, Hydra, and the tubellarian, Microstomum, feed upon each other. Hydra wounds or captures Microstomum only when the latter approaches it unawares. The Microstomum discharges from its pharynx a secretion that acts as a local anaesthetic so that the polyp seems not to be disturbed when the worm is feeding upon it. The Microstomum eats the polyp primarily for its defensive structures, the nematocysts.

The tissues of Hydra are digested within the enteron of Microstomum leaving the three types of nematocysts (penetrants, glutinants and volvents) behind free of their cnidoblasts. These nematocysts are taken up by the endoderm and delivered to the mesenchyme. Here phagocytes ingest and digest the lasso-type of nematocysts (volvents) which would be of no use to the Microstomum. The penetrants and glutinants (stinging threads) are carried by phagocytes to the epidermis where, in cooperation with epidermal cells, the attending phagocytes (cnidophages) orientate the nematocysts and retain them indefinitely (for three or more generations). These orientated nematocysts are used by the Microstomum in wounding other animals that disturb it.

So many cells of Microstomum cooperate in the manipulation of the nematocysts that one is tempted to remark that a Microstomum is all cooperation as Weismann said that "A whale is all adaptation."

86. Water filtration by the oyster and a new hormone effect thereon. T. C. Nelson, Rutgers University. (Lantern; 15 min.)

Previous attempts to measure the water filtered by an oyster produced very diverse results. Introduction of a tube into the cloacal chamber interferes with normal operation of the branchial hearts described by Hopkins and may disturb the visceral ganglion. Also, in Ostrea virginica much of the water from the right demibranchs leaves by an asymmetric chamber on the right side and separate from the cloacal chamber. With a modification of the rubber apron of H. F. Moore, '08, all the water passed by an oyster may be measured without interference with normal activities of the mollusc. Below 10°C. little water is filtered, but above this temperature water output rises rapidly to a maximum at 30°C. This was at the rate of 26 liters per hour in an oyster 11.5 × 8.9 cm. A total of 111 liters was filtered in 7 hours at 24 to 27°C. Above 30°C. the flow decreases very rapidly. Introduction of fresh oyster sperm causes, in males only, immediate and marked increase in rate of flow through enlargement of ostia and wider opening of the shells. Typical increases are from an average of 5.9 liters an hour to 10, and from 2.8 liters to 5.8. No response occurs in the female unless it spawns, in which case water filtration is much reduced for an hour or longer.

87. The growth of the mussel, Mytilus edulis, at Woods Hole, Massachusetts. II. Oscar W. Richards, Yale University. (Lantern; 15 min.)

The growth of mussels in a live box placed under the Bureau of Fisheries wharf has been measured at frequent intervals since 1930 (compare Anat. Rec., 1933, vol. 54, Suppl., p. 22). The individual animals were numbered so that the growth in length could be compared at successive intervals for the same animal. During the coldest part of the winter (January and February) there is little or no growth, then growth begins in late February or March, depending on the year, and continues until midsummer when it is again retarded. Another growing period occurs in the fall. The relation of the growth rings on the shell to the periods of retarded growth will be illustrated. Comparisons are now possible for the amount and rate of growth both in terms of the age of the animals and by calendar years. The average length attained by the end of the first winter (one-half to two-thirds year old) is 19 mm., second 34 mm. and the third winter 50 mm. The temperature changes of the ocean follow the same form, but some years, notably 1933–1934 and 1934–1935, were colder at the coldest period and the present year the maximum temperature in the summer was less than the previous years studied. The effect of temperature on growth will be demonstrated. The greatest mortality occurs during late summer.

88. The combined effects of heavy water and temperature on the heart rate. T. Cunliffe Barnes and J. Warren, Yale University. (Lantern; 10 min.)

Isolated turtle auricles were suspended in 2 cc. samples of oxygenated Ringer solution containing different percentages of heavy water. The slowing of the frequency of beat was proportional to the percentage of heavy water. Thus the time for ten beats at 10°C. was 48 seconds in a control, 61 seconds in 50 per cent

D_2O, 108 seconds in 80 per cent D_2O and 111 seconds in 96 per cent D_2O. The effect of a given percentage of heavy water can be expressed in terms of a drop in temperature of a certain number of degrees. In both ordinary and heavy water the log of the frequency of the beat shows a rectilinear relation to the reciprocal of the absolute temperature.

The temperature characteristics are in some cases the same in both media. Thus a value of 16,000 calories was obtained in ordinary water, 80 per cent D_2O and 96 per cent D_2O in spite of the great difference in frequency. Hence it is concluded that heavy water even in high concentrations does not necessarily change the fundamental regulation of the heart but reduces the rate of pulsation because of its lower zero point energy. No signs of injury were observed.

89. The non-glomerular origin of urine after sublimate poisoning of the tubules of the perfused frog kidney. Rudolf Theodore Kempton, University of Pennsylvania and Princeton University. (Introduced by Arthur K. Parpart.) (Lantern; 10 min.)

Changes in the rate of urine flow from perfused frog kidneys whose tubules had been poisoned with corrosive sublimate have been interpreted by other workers as the result of changes in glomerular function. This interpretation is based on the assumptions that 1) the tubules were rendered completely functionless, 2) that the glomeruli were undamaged, and 3) that the fluid appearing in the ureter originated in the glomeruli as usual.

A study of the validity of these assumptions was made in view of their relation to the evidence for glomerular secretion. Histologically the tubules appeared generally damaged, while the glomeruli showed no change. However, the results of the experiments forced the conclusion that the 'urine' might arise independently of the glomeruli after the tubules were poisoned. In some experiments all the 'urine' appeared to arise in this manner, while in no experiment did all the 'urine' appear to be glomerular in origin. The non-glomerular source of the ureteral fluid seemed to be the passage of perfusion fluid through the damaged walls into the tubules.

In view of the non-glomerular origin of appreciable amounts of urine after poisoning, changes in rate of flow under these conditions can scarcely be definitely attributed to changes in the glomeruli.

90. Alcoholic solutions as gastric secretogogues. E. E. Just, Howard University. (5 min.)

Of several mixtures containing alcohol, that of Italian vermouth (dry) and gin was found by the author in experiments upon himself to be the most effective in promoting gastric secretion. Neither the vermouth nor the gin alone was as good. The mixture acted best on an empty stomach and increased the secretogogue-action of soup taken soon after it. Simultaneous smoking inhibits the secretogogue-action of all the alcoholic mixtures investigated.

91. Studies on hair growth in the immature white rat. Earl O. Butcher, Hamilton College. (Lantern; 15 min.)

As a means of obtaining information on hair growth in the immature rat, auto- and homoiotransplantations of skin were made, sections being shifted to another region where the activity and the character of the hair were quite different. When areas were interchanged between the dorsum of the head and the back on the same individual, the characteristics of the hair and the skin were not altered by their new environment. Merely lifting the skin and suturing it back in place induced a precocious appearance of the hair around the wound. It would, therefore, seem that the factors responsible for the character of the hair reside in the skin, and that an acceleration of growth was caused by increased vascularization as a result of the injury. In the homoiotransplants, only young donors (1 to 7 days) supplied compatible grafts in older rats. The hair on the graft grew then according to the cyclic activity of the host, and buds from the surface and from the base of previous follicles produced it. These experiments demonstrated that the time of growth of the hair is determined mainly by factors from within the animal's body.

92. Circular and spiral drift in cutaneous tactile fields. A. A. Schaeffer, Temple University. (Lantern; 15 min.)

The definite fixation of a point in a 'space field' by any of the 'space' senses seems to be impossible when a reference frame is lacking: 1) a spot of dim light on the walls of a dark room appears to move (the so-called autokinetic sensation). 2) Some element in the kinaesthetic sense prevents one from maintaining a straight course in walking, swimming, driving automobiles, or flying blindfolded. Experiments on cutaneous tactile fields have shown that these fields also are subject to a drift.

When the skin is stimulated by water from a shower bath, almost the entire body surface is found to consist of tactile fields ranging in size from about 5 cm. to 50 cm. in diameter. These fields are characterized by very pronounced surges which move in circular or elliptical paths although the body is stationary. The paths are circular or broadly elliptical on the chest and back and narrowly elliptical or linear on thighs, arms and across the lumbar region.

The time of one revolution varies from 1 to 3 seconds.

The direction is either right or left. The center of the circle is not necessarily in the median plane. The space pattern and direction pattern are markedly and definitely different in different individuals. The general bodily condition has comparatively little effect on the tactile field drift, but the condition of the skin appears to have a marked effect.

93. Modifiability of motor responses to light in lower animals. Manton Copeland, Bowdoin College. (Lantern; 15 min.)

Many factors may influence more or less decidedly the responses of lower animals to light. One type of modified reaction is well illustrated by the behavior of Nereis virens. When a worm is allowed to enter a glass tube open at both ends it carries on undulatory movements of the body which draw the sea water

through the tube. If stimulated by juices emanating from a fragment of clam dropped in the water at the end of the tube, Nereis moves forward and seizes the food. Under these conditions an individual may be kept in the laboratory for a long time and typically is seen to be somewhat negative to shading. When, however, decreased illumination is followed by stimulation by clam juices the worm, after a time, appears to associate the two, and advances regularly to the end of the tube when the light is altered in the absence of food stimulation, evidently having formed a conditioned response. Several worms have been induced to change their reactions in this way.

One worm in a box illuminated through red glass learned to advance rapidly to the end of the tube, where it gave striking evidence of hunting for food, after an electric light was turned on. Later the same reaction occurred when the animal was kept under constant illumination and was stimulated by extinguishing the light. Finally, it responded in a positive way to both increased and decreased illumination even when the two stimuli were applied on the same day.

94. Dark adaptation in organisms. William L. Dolley, Jr., University of Buffalo. (Lantern; 15 min.)

The process of dark adaptation has been studied in fourteen organisms other than man. A review of this work shows that various methods have been used by the various investigators; that the results obtained are not uniform; that the explanations of dark adaptation offered differ in important particulars; and that there is need for more work on more organisms and for more intensive work by several investigators on the same organism.

The need for more work is illustrated by the following facts. The discovery of Mast for Volvox that the effect of dark adaptation is definitely correlated with the preceding light adaptation has been as yet described for no other organism. The effect of darkness on Volvox after previous exposure to light for 2 hours is the reverse of that obtained after previous exposure for 9 hours. Moreover, the relation between temperature and the rate of dark adaptation has been studied on only one organism, Mya, by one investigator, Hecht. Similarly, there is no published account describing in any other organism the phenomenon reported by Dolley and Bowen for Eristalis, namely, that on exposure to darkness the sensitivity to light of Eristalis rises to a maximum and then declines. This is, however, confirmed by unpublished work by other investigators on two other organisms.

95. Structural and functional factors determining visual motor responses of the fiddler crab. Leonard B. Clark, Union College. (Lantern, motion pictures; 15 min.)

A pattern of a dark stripe on a light background moving in the visual field of the fiddler crab will cause a reaction. The response is determined by the eye stimulated, by the arrangement of the ommatidia on the eye stalks, by the angular distance between ommatidia, by the power of intensity discrimination possessed by the crab, and by the condition of the animal as controlled by previous illumination or darkness.

The animal responds in such a manner as to move away from the eye stimulated. Simultaneous stimulation of both eyes usually inhibits movement, but the ommatidia are so arranged on the eye stalks that such stimulation is seldom possible. To produce a reaction, a pattern must give a visual angle equal to at least twice the minimum angle between adjacent ommatidia. Intensity discrimination as shown by visual responses is poor at low intensities, becomes better as the intensity is increased until a maximum is reached. Exposure to darkness causes loss of orientation to light as well as loss of response to movement in the visual field. Evidence available indicates that the change in behavior is dependent upon the production of a hormone-like substance.

96. Light intensity and the locomotor response. John H. Welsh, Harvard University. (Lantern; 15 min.)

Our present knowledge of the effect of light intensity on the locomotor response of an organism indicates that animals which possess complex photoreceptors and move by means of muscles show an increase in speed of progression with an increase in light intensity over a limited intensity range. On the other hand, animals which move by means of cilia are not appreciably affected by a change in the intensity of illumination at least after primary orientation.

The work on light responses is gradually leading to an understanding of one of the complex chains of events within the organism. The elements involved in the light response in arthropods include the receptors, the sensory nerves, the intermediate connections in the central nervous system, the motor nerves, and the locomotor muscles. Frequency of discharge and thresholds may enter at several points in the chain to account for the change of response with changing light intensity.

The investigations of Hartline and others have shown the relation of light intensity to frequency of discharge over single fibers of the optic nerve. At the other end of the chain the frequency and amplitude of muscular contractions as a function of light intensity have been studied. It would appear to be possible to obtain a more complete picture of the part played by each set of units involved in the locomotor response of organisms to light.

97. Nervous responses to illumination in invertebrates. C. Ladd Prosser, Clark University. (Lantern; 15 min.)

Photosensitive neurones respond differently according to their degree of specialization. The most primitive photic response that has been observed electrically seems to be from the caudal photoreceptor of the crayfish, or from the epidermal photoreceptors of the earthworm. In the axones coming from these receptors the response to illumination is a gradual increase in frequency of impulses to a maximum with no 'on' or 'off' effect (Prosser, '34 and '35).

In view of the similarity of response it seems probable that the photosensitive cells of the crayfish caudal ganglion and of the earthworm are similar. The response in the siphonal nerves of the clam to a flash may be similar to the slow response in the crayfish or earthworm inasmuch as the photoreceptors are similar to those of the earthworm.

Arthropod eyes give retinal potentials which usually have 'on' and 'off' effects with rather a high maintained response between them (Hartline, '28). The response is modified very markedly as it is conducted through the nervous system. In the optic nerve of Limulus where there are no ganglion layers between the retina and nerve, Hartline and Graham ('32) found a response with less 'on' effect and more maintained response than the retinal potential. When the crayfish eye is illuminated the optic nerve and the pharyngeal commissures show much larger 'on' and 'off' effects than the retinal potential, and also less maintained response than the retinal potential. Farther back in the thoracic nerve cord the response diminishes.

Rhythmic discharges of synchronized impulses have been observed in the eye stalk of the crayfish. Adrian ('32) observed similar rhythmic discharges in the optic lobes of Dytiscus.

It appears that alterations in the photic response, tending to complexity, are introduced in each ganglionic region.

98. Photoreceptors of lower animals. Walter N. Hess, Hamilton College. (Lantern; 15 min.)

Lower animals are able to perceive light through the agency of: a) light receptive body surfaces; b) special light receptive cells in or just below the body epithelium; c) pigment cup ocelli; d) and ocelli bearing lenses. Amoeba is equally sensitive to light over its entire surface, but many protozoa, such as Paramoecium, are more sensitive on the dorso-anterior surface. In flagellates photosensitivity is localized in the clear protoplasm just in front of the pigment of the eye spots and many of them possess lenses. Most metazoa possess photoreceptor cells. While these cells differ in their morphology they have one characteristic in common in that the sensitive elements are sense cells which, with their connecting nerve fibers, form neurones. Earthworms, leeches and certain molluscs possess photoreceptor cells which have an inner optic organelle composed of lens and retinella. In the earthworm these cells are found in the body epithelium, and in nerve enlargements in the prostomium and caudal segment. In Mya they are found in the siphon walls. Dolichoglossus possesses, just below the body epithelium, what appear to be photoreceptor cells. These resemble rods and cones. In flatworms and leeches the photoreceptor cells are located in pigment cups. In certain molluscs, insects, starfish and others are found ocelli resembling the eyes of vertebrates in that there is only one lens for each ocellus. Many animals are able to determine the direction of light because of the location of the photoreceptor cells. Those possessing pigment cup ocelli, and those with ocelli having lenses are especially well adapted for the perception of light direction.

By demonstration

99. The manipulation of Hydra's nematocysts by Microstomum. William A. Kepner, W. C. Gregory and R. J. Porter, University of Virginia.

See abstract no. 85.

100. A METHOD FOR THE MEASUREMENT OF THE HEAT PRODUCTION OF SMALL ORGANISMS. Ivon R. Taylor and Frederick Crescitelli, Brown University. (Diagrams and pictures.)

Using a principal not previously employed in this type of work, a method for measuring the rates of heat production of small organisms has been developed. The technique involves the measurement of the quantity of heat (calories), generated electrically, which must be added to one calorimeter in order to balance the heat as it is released by the organism in a second calorimeter. The calorimeters (two small, silvered Dewar vessels), which must be accurately matched regarding heat loss and heat capacity, are arranged differentially and are connected by means of a thermopile leading to a galvanometer. The apparatus is largely automatic in its operation due to the use of a photoelectric cell, an electromagnetic counter and accessory equipment. Tests of this method by the liberation, electrically, of known quantities of heat into the animal calorimeter have shown that in point of accuracy this technique compares favorably with other existing methods used in this type of work. The method has proved to be entirely satisfactory in measuring the rates of heat production throughout the development of individual pupae of the bee moth, an animal which weighs about 100 mg. on the average.

101. RETINAL CHANGES IN THE CATFISH OCCURRING UNDER CONSTANT EXTERNAL CONDITIONS. John H. Welsh and C. M. Osborn, Harvard University.

A study of the catfish (Ameiurus nebulosus) eye has shown that in constant darkness the average length of rod myoids of seven animals killed during the night was 7.3 μ, of seven animals killed during the day 20.3 μ. The cone myoids from animals killed at night averaged 35.3 μ and from animals killed during the day 18.1 μ.

In constant illumination there are no observable differences between 'day-light' and 'night-light' eyes.

Observations on the movements of the retinal pigment were not considered reliable after it was found that only the ventral part of the retina ever showed the pigment in the extreme dark position. If a diurnal change, in constant darkness, in the position of the retinal pigment occurs it is not marked.

Evidence to date indicates that the rhythm in the movements of the rods and cones either disappears after 2 days or the movements become out of phase with day and night. This must be checked by observations on the intact eye if such are possible.

A period of constant illumination of 8 days results in a temporary obliteration of any diurnal changes in the retina. Preliminary results from hypophysectomy indicate that retinal changes in the catfish are not affected by the removal of the hypophysis hence a persisting diurnal secretory cycle in this organ does not account for the changes.

102. THE NON-CELLULAR SPACE IN TISSUES. Arthur K. Parpart, Princeton University.

If small pieces of tissue be enclosed in a pressure chamber attached to a CO_2 tank and the tissue brought into equilibrium with the CO_2 at normal tank pressure, then upon sudden release of the pressure the CO_2 bubbles out of the tissue.

These bubbles of CO_2 form in the non-cellular regions and rush to the surface of the tissue, thus carrying the intracellular fluid with them.

A marked change in weight of the tissue accompanies the first few treatments of this sort. By the fifth or sixth treatment the change in weight is very slight and constant, indicative of the loss due to the experimental procedure involved. Values obtained for the non-cellular portion of the sartorius and abdominal muscles of Rana pipiens, vary between 13 to 16 per cent and 19 to 22 per cent by weight, respectively.

103. Hyperactivity of the pars intermedia as a graft in the tadpole. William Etkin, College of the City of New York and American Museum of Natural History.

Materials and methods—see abstract no. 13.

In a hypophysectomized host a successful hypophyseal graft does not ordinarily result in a mere return of normal pigmentation, but in the gradual increase in melanin until the animal becomes intense black. This blackness may persist indefinitely.

That this is not due to any hypersensitivity built up in the hypophysectomized host tissue is shown by the transplantation of primordia which induce the same melanosis.

Sections of such grafts show no indications of hyperplasia or any unusual growth reaction.

An extra hypophysis grafted into a normal tadpole produces the same intensification of pigment.

To account for these facts it may be assumed that the pars intermedia is normally inhibited by neighboring factors from which it is freed by transplantation. It is suggested that the inhibiting factor involved is nervous, through the tractus hypophyseus.

104. The hormonal control of secondary sex characters in finches. Emil Witschi, State University of Iowa.

A number of skins, microscopical slides and photographs will be exhibited to demonstrate the effect of hypophysis, thyroid and gonads on secondary sex characters in birds.

105. Histology and physiology of urinary elimination of vitamin C. A. Giroud and C. P. Leblond, Faculty of Medicine, Paris. (Introduced by Edgar Allen.)

Using the silver nitrate method for histological detection of vitamin C and Tillman's method for its titration, four organs appear to be very rich in the vitamin: suprarenal cortex, corpus luteum, testicle (interstitial cells only), and anterior part of hypophysis (eosinophilic cells).

With these two methods, the urinary elimination of vitamin C can be examined.

In species which under suitable dietary conditions may become scorbutic, the elimination rapidly follows every ingestion or injection of vitamin C. When receiving the usual diet, rich in fresh vegetables, the histological reactions of

vitamin C in the kidney are weak; when the animals are given large amounts of vitamin C (25 or 50 mmg. of ascorbic acid intravenously injected) marked reactions are observed in the convoluted tubules and the descending parts of Henle's loops. No reaction can be observed in the ascending parts and distal convoluted tubules.

In species which synthesize vitamin C (rat and cat) definite reactions of the convoluted tubules occur, even when the diet does not contain vitamin C.

106. SPONTANEOUS STERILITY IN THE MALE RAT. George K. Smelser, Columbia University.

See abstract no. 56.

107. A SECOND METHOD OF CONTRACTION IN VERTEBRATE STRIATED MUSCLE. Ulric Dahlgren, Princeton University.

No abstract received.

108. AN INTERNAL CHARACTER IN THE CYRTACANTHACRINAE (ORTHOPTERA, ACRIDIDAE) OF POSSIBLE TAXONOMIC VALUE. Eleanor H. Slifer and Robert L. King, State University of Iowa.

Paired sac-like abdominal glands which open to the exterior below the ventral valves of the ovipositor were noted, a number of years ago, in Melanoplus femur-rubrum by J. H. Comstock and V. L. Kellogg. It has been found, in the present study, that these structures belong, microscopically, to that class of tissues described, in other insects, as 'odoriferous.' An examination of twenty-four species of Cyrtacanthacrinae, twenty-one species of Oedopodinae and eight species of Acridinae has shown the glands to be present in all members of the first subfamily mentioned above and absent in all members of the other two sub-families. These organs, then, may be of some interest to the taxonomist; especially since their presence or absence may be demonstrated in dried specimens by softening and cleaning the tip of the abdomen in a solution of strong alkali.

By title

109. METHODS OF REPRODUCTION OTHER THAN BINNARY FISSION IN CERTAIN SPECIES OF FREE-LIVING AMOEBAE. Redginal Hewitt, Syracuse University. (Introduced by V. F. Lindeman.)

During a series of investigations on three species of free-living amoebae, it was found that two of the species reproduced frequently by multiple fission.

In the case of a small amoeba isolated from soil and cultivated on agar, encystation took place after a short period of vegetative activity. Upon transferral to a new medium these cysts gave rise to a number of amoebulae which grew to adult size in about 3 weeks.

A second species, isolated from an aquatic habitat and cultured on agar, produced small amoebulae after a series of complicated nuclear changes. Prior to amoebulae formation adult organisms became spherical in shape. The nucleus fragmented and these fragments escaped into the cytoplasm. Small amoebulae

or agametes were formed from the nuclear fragments and were expelled into the surrounding medium. These amoebulae never grew to the size of the parent even after transferral to their normal habitat.

No method of reproduction other than simple fission was observed in three strains of Amoeba proteus studied, although several thousand individuals were kept under constant observation in media of different composition for a period of 7 months.

110. The effects of salts on reversal in ciliary action in Paramecium multimicronucleatum. Joseph F. Oliphant, Johns Hopkins University. (Introduced by S. O. Mast.)

Mast and others observed that monovalent cation salts induce reversal in ciliary action in Paramecium and that polyvalent cation salts with few exceptions do not. These observations were extended.

One washed paramecium was taken with a capillary pipette and dropped into 5 cc. of the chemical to be tested and the time it swam backward measured. This was repeated many times in a number of concentrations of each of many salts. Temperature, hydrogen ion concentration and salt content of culture and wash solutions were carefully controlled.

1) The order of effectiveness of monovalent cations in inducing ciliary reversal in K Li Na NH_4, and the order is independent of the anion in the salt and of temperature. 2) The duration of reversed ciliary action in a monovalent cation salt solution varies directly with concentration of salt and inversely with temperature. 3) Temperatures up to those which cause heat death do not induce reversal but reversal is induced by temperatures which cause heat death. 4) The effect of combinations of monovalent cations in inducing reversal is not addative. 5) Reversal is not directly correlated with osmosis or the hydrogen ion concentration in the environment.

The results seem to indicate that reversal is associated with increase in protoplasmic viscosity but that there are other factors involved.

111. The effect of silicon on growth and respiration in Chilomonas paramecium. S. O. Mast and D. M. Pace, Johns Hopkins University.

If different quantities of silicon are added to different acetate-ammonium culture solutions containing Chilomonas paramecium, the rate of division (as the concentration of silicon increases) rapidly increases to optimum, then gradually decreases to zero. The optimum concentration of silicon is 0.2 mg. Na_2SiO_3 per 100 cc. and the increase in the rate of division at the optimum is 26 per cent.

In acetate-ammonium culture solutions containing neither sulfur nor silicon, chilomonads divide only a few times if at all and live less than 24 hours, but if silicon is added in optimum concentration they live 5 days with an average division rate of 2.12± per day for the first 3 days. Silicon can therefore, to some extent, be substituted for sulfur.

In acetate-ammonium culture solutions without silicon (at 25°C.) the average oxygen consumption per hour per 10,000 individuals is 0.18± mm^3. In this solution plus silicon in optimum concentration it is 0.27± mm^3. Silicon probably functions as a catalyst in oxidation.

112. Regeneration and growth in Planaria maculata under the influence of endocrine feeding. E. D. Goldsmith, Washington Square College, New York. University. (Introduced by Harry A. Charipper.)

Groups of Planaria maculata, the individuals of which measured 5 to 8 and 9 to 12 mm. in length, were fed, 1) liver, 2) anterior pituitary, and 3) thyroid on alternate days and, in some cases, daily for 124 days. A fourth group received anterior pituitary and thyroid on alternate feeding days. Fresh beef glands were used.

During the 124-day period each worm had its anterior end removed four times, twice by incisions directly posterior to the eyes, once directly anterior to the anterior extremity of the pharynx, once directly posterior to the pharyngeal pore. The time for head regeneration was noted. The animals fed on endocrines regenerated at approximately the same rate as those on liver.

Worms 5 to 12 mm. in length receiving liver exclusively, as well as worms approximately 3 mm. in length which had received no food since emerging from their capsules, were found to grow when fed thyroid gland for periods ranging from 15 to 65 days (compare Castle, '28), Planaria velata; Wulzen's ('23) data and conclusions, Planaria maculata).

The potency of the thyroid material was tested on Rana sylvatica larvae. Tadpoles feeding on this tissue or kept in aquaria containing an aqueous extract of it showed greatly accelerated metamorphosis.

It was impossible to detect any influence of mammalian endocrine tissue on the growth or regeneration of the invertebrate form used in these experiments. It was noted that the thyroid group laid a very small number of egg capsules as compared to the other groups.

113. The eyeless cave flatworm, Spalloplana percaeca. J. William Buchanan, Northwestern University.

The American cave flatworm, Spalloplana percaeca, has a capacity for regeneration approximately equal to that of the white, outside-living Procotyla fluviatilis, namely, ability to reconstitute the whole from parts taken from the anterior third of the animal. No eyes appear in the regenerates. The cave worm does not orient to light but writhes violently when exposed to bright sunlight (4000 foot candles), and may be killed by a 2-minute exposure. It does not orient with respect to gravity in low oxygen tensions, foul water, in high or low temperature, nor under water pressures up to 20 pounds per square inch. It is agitated by water currents and by the passage of water films over its surface but does not exhibit orientation. It appears to be indifferent to H ion concentrations between pH 6.6 and pH 8.0, but shows a sharp avoiding reaction to 1 per cent HCl and to 1 per cent NaOH. It shows no orientation to temperatures between 4° and 55° and tolerates temperatures up to 24° for many hours. It is highly susceptible to KCN, much less so to a hypotonic environment. It does not readily absorb methylene blue in either the reduced or oxidized form. When colored with methylene blue there are indications of an antero-posterior color gradient and when disintegrating after treatment a double disintegration gradient is detectable. In many of its reactions the cave form more closely resembles the surface living Procotyla fluviatilis than Fondicola or Euplanaria.

114. Peristalis and physico-chemical differences along the longitudinal axis of the earthworm. N. S. Royston Maloeuf, Cornell University. (Introduced by H. D. Reed.)

There is a rise in total solids and in total organic material, in terms of living weight, from the anterior region of the worm to the clitellum. There is then a continuous decline posteriorly. This applies both to the body wall and to the total worm. There is a similar rise in total fat content from the anterior to the clitellar region. There is then a continuous decline to the posterior four-fifths of the worm. This is followed by a second rise in the posterior end. There is less reduced glutathione per wet weight in the anterior region of the worm than in the rest of the worm. Differences in reduced glutathione content along the remainder of the longitudinal axis have no significance when reckoned in terms of wet weight. There are no consistent differences in the rates of oxygen consumption by different parts of the body wall with the exception of the anterior region which has an apparently lower rate. Very small pieces which showed no gross behavior were used in the manometers. The normal, antero-posterior direction of peristalsis is, thus, not directly correlated with physico-chemical differences along the longitudinal axis of the body wall.

The transmission of the excitation involving peristalsis occurs in the nerve cord and not in the muscular tube of the body wall. There is normally an antero-posterior gradient of dominance in the nerve cord and, conversely, a postero-anterior gradient of subordination.

115. Fragmentation in the naid Nais paraguayensis Mich. 1905. Libbie H. Hyman, American Museum of Natural History.

Nais paraguayensis unlike other Naididae does not form fission planes but reproduces asexually on attainment of maximum length (about 35 mm.) by spontaneous fragmentation into several pieces which regenerate completely in 1 day at 25 to 27°C. Fragmentation can be induced at will by simple isolation into clean water without food. Fragmentation after such isolation occurs more slowly the lower the temperature and the smaller the size; it is inhibited altogether at 15°C. and often fails to occur at 10 to 12 mm. length. The number of fragments formed depends on the size of the worm. The head fragment is always longer than the body fragments. Decapitation accelerates the fragmentation at any temperature and at any size. If worms are cut in two, the posterior halves fragment much sooner than the anterior halves. Stronger solutions of KNC (1/25000 mol. or stronger) inhibit the fragmentation without affecting appearance or behavior; concentrations can be found (around 1/50000, but varying with each trial) which accelerate the fragmentation. The length of the fragments appears not to be definitely affected by temperature, size, or decapitation except that very long pieces may result at the lower temperatures. Fragment length is definitely related to some factor which may be termed the senescence of the culture and is greater the older and more crowded the culture from which the worms are taken. The fragmentation process appears to depend on the relative dominance of head and body regions.

116. Action of salts on the heart of the oyster. Edward Walzl, Johns Hopkins University. (Introduced by S. O. Mast.)

It is well known that the action of solutions of sodium, potassium or calcium on the hearts of several different invertebrates is the reverse of that on the hearts of vertebrates.

This is also true for the heart of the oyster. If it is perfused with isotonic solutions of sodium or potassium chloride it stops beating in a state of contraction greater than normal systole, and with solutions of calcium or magnesium it stops in a state of relaxation greater than normal diastole. As the concentrations of these salts are decreased the effects on contraction and relaxation, respectively, decreases until the heart no longer stops beating.

Recovery from calcium relaxation on perfusion with Van't Hoff solution is preceded by a period of contraction suggestive of the effect of calcium on vertebrate hearts.

One would expect that since calcium solutions cause diastolic arrest, and potassium solutions, systolic arrest, that lack of the former would cause systolic arrest, and lack of the latter, diastolic arrest. However, the reverse is true.

Excess of potassium in Van't Hoff solution causes decrease in extent of relaxation, and excess of calcium, increase in amplitude and decrease in frequency of contraction.

Analysis of the results obtained leads to the conclusion that the action of salts on the hearts of vertebrates and oysters is fundamentally the same, and that the difference observed is due to quantitative differences in their action on excitation and contraction.

117. Influence of external stimuli in changing the sexual phase in mollusks of the genus Crepidula. W. R. Coe, Yale University.

Experiments on C. fornicata, which is normally protandric and sedentary after having passed the motile period of early life, showed that among 486 individuals in the functional male phase which were separated from their associates and forced to move about from time to time, no less than 80 per cent had begun transition to the female phase within 2 months, as compared with 15 to 30 per cent in the control groups.

Separating 370 functional males into 185 pairs, of which one member was forced to exert itself while the other was carried passively on the back of the former, resulted in striking differences in sexual phase at the end of 2 months. More than 80 per cent of the basal males had begun or completed the sexual transformation as compared with 31.4 per cent of the superimposed males. Removing the basal males from their shells was equally effective in initiating the sexual transformation of superimposed individuals, as were also other changes in the environment.

It is concluded that sexual transformation in Crepidula is comparable with metamorphosis in other animals in that the definitive, or female, phase of sexuality may be hastened or retarded by external conditions but that the sequence of sexual phases cannot be reversed.

118. Sequence of sexual phases in Teredo, Ostrea and Crepidula. W. R. Coe. Yale University.

Examination of the gonads of large numbers of individuals of each of these genera of mollusks at all ages, at all seasons of the year and during successive years shows that any tabulation of so-called 'sex-ratios' has little meaning. The functional phase, if any, in which any given individual is found, will, in general, depend upon, a) age, b) size, c) season, d) season when hatched, e) previous and present environments, including geographical location, and f) its particular combination of genetic factors. In Teredo the interaction of these influences results in the following observed individual variations in the sequence of functional sexual phases during the normal life span in the vicinity of Woods Hole and at New Haven:

1. Male..female..recuperation...female.
2. Male..female..recuperation...male..female.
3. Male..recuperation...female.
4. Male ('true male')..recuperation...male..(female?)
5. (Exceptional). Female..recuperation...(male?)

In Ostrea lurida similar variations are found on the coast of Southern California and in addition:

6. Male..female..male..recuperation...female..male, etc.

In O. virginica there is only a single sexual phase each year north of Virginia, the proportion of functional females at the first breeding season varying from 0 to more than 30 per cent in various environments. Facultative change of functional sexuality may occur at any age.

In the species of Crepidula found on the coast of southern New England each individual normally experiences only two sexual phases, or only one in those comparatively few cases in which the initial male phase is aborted.

119. The action of cupric chloride on the viscosity of Arbacia egg protoplasm. C. A. Angerer, University of Pennsylvania.

After exposure of Arbacia eggs to $CuCl_2$ centrifuge tests were made at various time intervals in order to determine the effect on protoplasmic viscosity. In all cases, an interval of time elapsed during which the metal produced no visible effect on the protoplasm. This time interval is a function of the concentration of copper in solution. At the conclusion of this latent period, there ensues a sharp rise in viscosity values resulting in an irreversible gelation (coagulation) of the protoplasm. The same type of reaction holds for $CuCl_2$ in sea water, in balanced medium, K-free, Mg-free, Ca-free solutions. The nature of the curves obtained on plotting viscosity values against immersion time in $CuCl_2$ solutions are essentially similar. However, the length of the latent period varies with the nature of the medium in which the copper salt is dissolved. Thus for 10^{-3} M $CuCl_2$, viscosity increase begins at 9 minutes in balanced medium; 7 minutes in K-free; 6 minutes in Mg-free, and 3 minutes in Ca-free solutions. The effective concentrations of $CuCl_2$ range up to 5×10^{-4} M for all solutions employed except for Ca-free mixtures. Here the effective concentration lies between 10^{-6} and 10^{-7} M. In a few of the eggs coagulation is observed even at the latter value.

These results differ markedly from those obtained in a similar experiment on amoeba protoplasm (1933). In the case of Arbacia egg protoplasm, unlike amoebae protoplasm, there is no concentration at which gelation is reversible.

120. The influence of temperature upon the respiratory regulation of an amphipod crustacean (Grammarus fasciatus). Verlus F. Lindeman, Syracuse University.

This series of experiments upon an amphipod crustacean bears out the previous observation upon aquatic invertebrates, that low temperatures are more conducive to a greater range of respiratory regulation than high temperatures.

In approximately forty-five experiments involving three different temperatures, the effect of oxygen tension on oxygen consumption has been studied. The animals were tested in groups, and the dissolved O_2 content of the water in the respiratory chamber was tested at various intervals by the Winkler method.

The temperatures employed were: 10°, 18°, 26°C.

The oxygen tension below which oxygen consumption becomes a function of oxygen tension was found to be approximately 1.40 cc. oxygen per liter of water at 10°C., and 2.10 cc. oxygen per liter at 18°C. At 26°C. the rate of oxygen consumption was entirely dependent upon the oxygen content within the range studied (1.5 to 4.9 cc. O_2 per liter of water), the amount of oxygen consumed per hour decreasing with decreasing oxygen content.

The results obtained in this experiment further emphasizes the importance of temperature as another environmental factor which must be controlled in determining the true respiratory ability of aquatic animals.

121. Studies in population physiology. V. The oxygen consumption of the flour beetle, Tribolium confusum Duval. Thomas Park, Johns Hopkins University.

An analysis was made of the weight and oxygen consumption of the flour beetle, Tribolium confusum Duval raised in conditioned and fresh flour and kept distinct as to sex. The Krogh microrespirometer was used in obtaining the rates of oxygen consumption. It was shown that: first, females weighed more than males; second, conditioning of the beetles does not significantly alter their respiration although there is a slight tendency for beetles raised in conditioned flour to respire faster than those raised in fresh flour; third, females had a higher oxygen consumption rate than did males. The evidence indicates that females respire faster than males because they weigh more and also because they are females. A statistical analysis of the data suggested that the weight difference between males and females was not the sole factor involved in explaining the higher oxygen consumption of the latter.

122. Studies in population physiology. VI. The effect of graded conditioned flour on the fecundity and fertility of Tribolium confusum Duval. Thomas Park, Johns Hopkins University.

In previous studies it has been shown that heavily conditioned flour, i.e., flour taken from and altered by concentrated Tribolium populations, drastically reduces the fecundity of the beetles. In the present study the effects of intermediate or graded conditioned flour upon productivity are being analyzed. Fecundity and fertility data were obtained for beetles living in the following environments: all fresh flour; ¾ fresh, ¼ conditioned flour; ½ fresh, ½ conditioned flour; ¼ fresh,

¾ conditioned flour; and all conditioned flour. The beetles produced, over a 30-day period, the most eggs in the fresh flour medium and fewest in the all conditioned medium. The forms in the ¼ fresh, ¾ conditioned environment exhibited a lower fecundity than those in the three less conditioned (or more fresh) environments. The oviposition rates were essentially similar for the beetles in the ¾ fresh, ¼ conditioned and ½ fresh, ½ conditioned flours but markedly lower than those of the beetles in fresh flour. In short, there is an indication that the fecundity of Tribolium is moderately sensitive to gradations in conditioned flour. As in previous experiments, the fertility of the eggs remained approximately the same irrespective of the culture medium.

123. The water content of Chortophaga viridifasciata nymphs and adults starved at different relative humidities. Daniel Ludwig, New York University.

Fourth and fifth instar nymphs and adults of the grasshopper, Chortophaga viridifasciata, were starved at eleven different humidities, ranging from 0 to 96 per cent, and at a temperature of 25±1°C. Water content was determined at the time of death by drying to a constant weight at 60°C. The time of survival was approximately the same (5.2 to 6.6 days) at all humidities employed. Hence, death was probably due to starvation rather than desiccation. The average normal water content of the experimental animals was 75.9 per cent. When starved at a humidity of 96 per cent, it increased to 82.4 per cent; while starvation at 82 per cent humidity resulted in no change in water content, and starvation at lower humidities resulted in a loss of water. In the $CaCl_2$ desiccator (humidity approximately 0 per cent), the animals had only 58.8 per cent water at the time of death. Between the humidities of 25 and 75 per cent, there was practically no difference in water content at the time of death, or in the rate of weight loss during starvation. Hence, between these limits, the animal is able to maintain a high level of water (68 to 70 per cent) probably by the conservation of metabolic water.

124. Relation between vitamins and the growth and survival of goldfishes in homotypically conditioned water. Gertrude Evans, The University of Chicago. (Introduced by W. C. Allee.)

Small goldfishes isolated in homotypically conditioned water have been shown to grow faster than controls isolated in unconditioned water (Allee et al., '34). To test the possibility that the growth promoting effect of conditioned water might be due to vitamins excreted by the conditioning fishes, assay fishes were fed, 1) a vitamin rich diet in conditioned water, and 2) the same diet in unconditioned water; 3) a vitamin free diet in conditioned water, and 4) the same in unconditioned water.

The synthetic diet used consisted of casein, starch and salts, with haliver oil, yeast and lemon juice added for the vitamin rich diet, which was also fed to the conditioning fishes.

On both vitamin rich and vitamin free diets, the fishes grew significantly better in conditioned than in unconditioned water. The two series in conditioned

water grew about equally well, and the two series in unconditioned water showed about the same degree of failure in growth. The effect of vitamins showed in better survival of the fishes on the vitamin rich than on the vitamin free diet, in the same kind of water. In one experiment after 140 days, the percentages surviving in the four series (see above) were: 1) 63 per cent, 3) 50.0 per cent, 2) 16.3 per cent, 4) 0.

Whatever the nature of the growth promoting factor in conditioned water, there is no evidence of the presence of a vitamin in so far as growth is concerned. Survival percentages indicate an actual vitamin effect of less importance than that due to conditioning.

125. The effect of intermittent light on the adaptation time of retinal pigment. L. B. Arey and R. G. Price, Northwestern University Medical School.

Dark-adapted fish (golden shiner) were subjected to intermittent light of varying frequencies and the degree of resulting light adaptation then judged with respect to five arbitrarily selected stages of expansion of the retinal pigment. For equal amounts of total illumination, intermittent light of certain flash frequencies proves to be noticeably more effective than continuous light in producing a response in the retinal pigment. A low flash frequency (six per minute), with light and dark periods of equal length, was found to be most effective in producing the earliest changes in pigment response. A frequency of thirty to sixty flashes per minute, with light and dark periods of equal length, was found to be most effective in producing the more advanced stages of light adaptation. Higher frequencies were impracticable with the apparatus used.

These findings are consistent with certain other known investigations which indicate a similar disproportionate effectiveness of intermittent light in human vision, phototropic responses of insects, photosynthesis and the production of latent images on photographic plates.

126. Sexual selection in fishes. G. K. Noble and Brian Curtis, American Museum of Natural History.

The cichlid, Hemichromis bimaculatus, can identify the sex of a fish of its own species in an adjacent glass aquarium. A fully adult female invariably lays her eggs on the side nearest the male's aquarium. When a female is given a choice between a male with erythrophores expanded by yohambine and a paler control she usually selects the former. Color alone is not effective, for males rendered inactive are not attractive. Although paired males are usually larger than females the latter do not select for size. Size difference is the result of competition between males. Staining a male red does not advance his position of dominance in a tank. Heightened color without movement is of no advantage in fighting or courtship.

The sex of fish wearing opaque eye covers cannot be identified because of the slowness of their movements. Mates of paired fish are identified by size, shape and details of their color pattern. A fish rendered inactive cannot be identified by its mate.

Although the female Hemichromis definitely selects the more brilliant males for mates this has not led to a marked sexual dichromatism because the male also selects the more highly colored females. On the other hand, in the sexually dichromatic Lebistes reticulatus, the bright colors are not attracting but intimidating devices. Males reared alone attempt to mate with both sexes but learn to avoid males. Females artificially colored like males are avoided by experienced males while males colored to resemble females are sexually attractive.

127. Effect of 2.4 dinitrophenol on the bioelectric potentials of frog skin. H. F. Rosene, University of Texas. (Introduced by E. J. Lund.)

To the author's knowledge no study has been reported regarding the effect of 2,4 dinitrophenol on bioelectric potentials. Such a study is of particular interest since it has been shown that 2,4 dinitrophenol accelerates tissue metabolism and also that continuously maintained potentials are linked with respiration. Concentrations of 0.5 mg. to 5 mg. of 2,4 dinitrophenol in 100 cc. Ringer's had upon application an immediate depressive effect on the potential difference of frog skin, the drop continuing to a final value of a few millivolts or zero, depending upon the concentration and time of exposure. With short exposures of an hour or less the effect was reversible. In dilutions of less than 0.3 mg. dinitrophenol in 100 Ringer's, depressive effects were absent. Concentrations of 0.03 mg. to 0.05 mg. dinitrophenol in 100 cc. Ringer's showed an *increase* in potential in over 80 per cent of the experiments.

128. Functioning hypophyseal transplants in Amphibia. Wayne J. Atwell, University of Buffalo.

The epithelial hypophysis has been removed from ninety-three specimens of Rana sylvatica, thirty of R. pipiens and thirty of Amblystoma punctatum (maculatum), at the tail-bud stage and transplanted in the same individual to a location between the right otic vesicle and the hindbrain. Care was taken not to include any brain tissue or entoderm. Serial sections of head and thyroid and toto preparations of the gonad-adrenal region have been studied from ninety-five of these animals. Records and sections of over 200 normal, completely- or partially-hypophysectomized amphibia were utilized as controls.

Pigmentary condition was taken as an indication of the state of function of the pars intermedia. Function of the anterior lobe proper was evidenced by 1) definite progress toward metamorphosis, 2) preservation of the normal size and structure of the thyroid, 3) maintenance of the size and lipoid content of the adrenal cortex. For a transplant to be deemed entirely successful, study of an animal was required to show 1) entire absence of epithelial hypophysis from the orthotopic position, 2) characteristic hypophyseal tissue in the region of the transplant, 3) evidence of function of the transplant as given above. Twenty-six such specimens of the wood frog and two of the leopard frog have been found in the material studied, but none of Amblystoma. All of these twenty-eight showed evidence of function of the anterior lobe, except three which were sacrificed prior to complete differentiation of the thyroid and the appearance of legs. These three and eleven others showed a condition of normal or partial darkness indicative of pars intermedia function.

129. The urodele pancreas and liver in hypo- and hyperpituitarism. A. Elizabeth Adams and Elsie N. Ward, Mount Holyoke College.

The pancreas (weight of gland, number of islands and their cellular condition) and the liver (glandular and glycogen weights, fat and glycogen content of cells) were studied in four groups (fifteen each) of adult male Triturus viridescens: 1) normals; 2) normals after fourteen injections of phyone, an anterior pituitary extract; 3) 2 weeks after hypophysectomy; and 4) hypophysectomized animals after fourteen injections of phyone.

Compared with normals, the hypophysectomized group 2 weeks after hypophysectomy showed a decrease in pancreatic weight, in size of island nuclei and in hepatic glycogen and an increase in island number, in 'pink' (alpha) island cells, in liver weight, and in fat content of the liver. The increase in island number and in liver weight and the decrease in size of island nuclei were significant statistically.

Injections of phyone into normal animals for 2 weeks caused an increase in pancreatic weight, in island number, in 'pink' (alpha) island cells, and a decrease in size of island nuclei, in liver weight (slight), in liver glycogen, and little or no change in the fat content of the liver. The increase in island number and decrease in size of island nuclei were significant statistically. These changes except for a greater increase in island number are less marked than in the hypophysectomized group.

Injections of phyone into hypophysectomized newts maintain the glandular conditions of pancreas and liver at approximately normal levels.

130. Seasonal and temperature-induced changes in the thyroid of Bufo valliceps. A. H. Morgan and Miriam Stokes, Mount Holyoke College.

Thyroid glands of the southern toad, Bufo valliceps, were examined for seasonal changes, especially in winter, and for the effect of experimentally lowered temperatures.

Preliminary temperature tests were made upon behavior, e.g., burrowing, pharyngeal breathing, cessation of spontaneous activity.

Series of toads were kept from October to April under laboratory conditions in three ranges of temperature: 7.0° to 13.0°C., 10.5° to 16.8°C., and 18.6° to 23.2°C., the higher temperature in each case occurring in the warmer months. The microscopic appearance of thyroids of the three series agreed in indicating low activity in October and November, with an increase in activity in December, maintained through February and increased again in March. Thyroids of toads killed in February when hibernating out of doors resembled those of toads in the laboratory series killed on the same date.

Further series of toads subjected to low temperatures (3°C.) in December had thyroids showing high or moderate activity.

131. The effects of natural and experimental low temperatures on the thyroids of Rana pipiens and Triturus viridescens. A. H. Morgan and Elizabeth K. Moyer, Mount Holyoke College.

Rana pipiens and Triturus viridescens killed immediately after removal from their natural habitat (temperature 1°C.) during hibernation or partial hibernation showed typically active thyroids.

Individuals of the same species exposed to a constant temperature of 0.5°C. for 42 days showed similarly active thyroids.

Thyroids of hypophysectomized newts were apparently less affected by low temperature than normal newts.

132. Studies of islet and acinar tissue variations in the pancreas of the rat. Walter N. Hess and Clinton W. Root, Hamilton College.

This study was undertaken to ascertain the number of islets in rats of different age groups, from 1 to 136 days; to show the relationship of the islets to the acinar tissue and to the body weight; and to discover factors that change these relationships. At birth the Wistar colony rats have more islets per unit of pancreatic tissue and of body weight than older rats. At the age of approximately 40 days the number of islets per unit of weight of pancreas and of body weight becomes practically constant and continues so throughout the 136-day period.

Factors were studied which tend to change the relationship of the number of islets to weight of pancreas. These included the effects of starvation, of exercise, and of the addition to the standard diet of various combinations of cholesterol, lecithin and lard. All of these factors except the addition of lard cause an increase of islets per 100 mg. of pancreas. Greatest increases in islets were obtained with the addition to the diet of cholesterol and lard, and of lecithin and lard.

A decrease in the number of islets per gram of body weight occurs when lard is added to the diet, or when the amount of food is increased. Muscular activity, however, increases this ratio. These results are similar to those obtained in earlier experiments on fish.

133. Autolysis of anuran tail muscle in vitro. F. W. Dunihue, New York University. (Introduced by O. M. Helff.)

Resorption of anuran tail muscle during metamorphosis is initiated and completed in the proximal before it is in the distal tail regions. It seemed probable that Bradley's theory of autolysis might offer an explanation of this differential histolysis. The theory states, in part, that proteins are available substrata for autolysis only when in the acid protein state or at a pH slightly below the isoelectric point. If this part of the theory is to explain differential tail resorption, one of two conditions must prevail. Either the proteins of the tail are arranged along the proximo-distal axis in a series of decreasing isoelectric points and, as a result of this, proximal muscle autolyzes at higher pH values than the distal, or regional differences in tissue pH exist along this axis.

To test the former possibility, equal weights of muscle from proximal and distal regions of the tail were allowed to autolyze in vitro in buffered solutions at pH values of 3.0, 5.4, 6.6, and 7.2. pH 6.6 was optimum for autolysis of tissue from both regions; yet proximal muscle autolyzed more rapidly and completely than distal. At pH 7.2 the same differential autolysis was evident, although total autolysis was less. Below 6.6 autolysis was very slight and was approximately the same in both regional tissues. The results substantiate the differential histolysis established on histological findings by Clausen. They also indicate that a proximo-distal gradient of isoelectric points of the muscle proteins is not responsible for the differential autolysis.

134. The sensory mechanisms involved in the migration of newly hatched fresh water turtles. G. K. Noble and A. Braslovsky, American Museum of Natural History.

The escape of recently hatched Chelydra serpentina and Chrysemys picta from the nest is aided by the fact that these turtles are negatively geotropic on slopes greater than 10 per cent. Additional factors direct their migration toward water. The turtles move toward areas of high humidity but are not attracted by odors of pond water. They move into areas of optimum temperature, approximately 20°C., but are not influenced by the movement of adjacent forms. They are strongly phototropic to red, green and blue-violet light and are especially sensitive to red. In a choice between luminous surfaces of equal intensity but different area, preference is given to the larger area. In a choice between a small area of high intensity and a larger one of lower intensity the former has a greater attraction. Blacking the horizon does not modify the results if the luminous areas retain their original size and intensity.

Humidity at its optimum is more effective than negative geotropism in directing the movements of these turtles. Light is more effective than either humidity or gravity. Although moisture, temperature and gravity influence the behavior, the migration of the turtles is directed chiefly toward the largest areas of bright light.

135. The effects of ovariotomy and hypophysectomy on parturition in snakes. H. J. Clausen, American Museum of Natural History.

Viviparous snakes, including three species of water and two species of garter snakes, were used in studying the endocrine influence on parturition. More than seventy-five female snakes in various stages of gestation were utilized.

Ovariotomy during the early gestation period resulted in resorption of embryos. Removal of the ovaries during the middle of the period resulted in the birth of dead embryos near the end of the normal gestation period, growth being retarded but not completely inhibited. Removal at a late period of gestation had no effect on the normal gestation or parturition process. Hypophysectomy during early gestation brought about resorption of young. Removal of the hypophysis during the middle or late stage resulted in the death of the embryos, premature parturition, and in some instances resorption. Injection of posterior lobe extract had no effect on the normal gestation period in the early or middle stages. Injection of extract during the relatively late stage resulted in immediate parturition. Whole gland (sheep pituitary) injections had the same effect as posterior lobe extracts.

Results so far seem to indicate that the normal birth mechanism is due to a series of events similar to those found in some higher forms. Interference with one link of the series, e.g., removal of the ovaries, the hypophysis or injection of certain hypophyseal extracts disorganizes the normal mechanism. The influence of endocrines and the relationships of the yellow bodies of the ovaries to gestation and parturition in snakes are being further investigated.

136. Asymmetry in the feather of the guinea fowl. Mary Hardesty, Tulane University.

Asymmetry in the structure and pattern of a feather may be analyzed into several factors. Opposite barbs may be different in length, different in age at maturity, different in pattern phase, different in linear growth rate, and they may have been laid down at different rates. The two halves of the rachis may be different in length, as indicated by curvature, and they may have barbs differently spaced along them.

When the asymmetry of guinea feathers was analyzed with the aid of their regular pattern periods, it appeared that there was a difference in the growth rate of the two halves of the rachis of not more than 0.3 per cent and a difference in the growth rate of opposite barbs of not more than 7 per cent.

These differences were small compared with barbs 50 per cent longer on one side than on the other (in wing feathers). On the side where longer barbs occur, which may be either the convex or concave half of the feather, one finds that the time required to reach maturity is longer. Corresponding to this the barbs remain for a longer time on the collar line and, without perceptibly increased rachis growth rate, are more closely spaced on the rachis. This agrees with the presence of more barbs on an isochrone line. These facts easily explain the spatial disjunction of corresponding pattern cycles on the two halves of the rachis.

137. Rate of locomotion and dark adaptation in Dineutes nigroir (roberts). Willard J. Trezise, Johns Hopkins University. (Introduced by S. O. Mast.)

If dark adapted specimens of Dineutes are exposed to constant illumination of any intensity between 0.0073 and 868 foot-candles, the rate of locomotion is at first high ('maximum') for 30 seconds, then it decreases very rapidly to a minimum, after which it remains nearly constant for at least 30 minutes.

If dark adapted specimens are subjected to light of any intensity, between 0.0073 and 868 foot-candles, the 'maximum' rate (as the time in darkness increases) increases for about 1 hour and then slowly decreases.

If specimens are subjected to darkness for 1 hour and then exposed to various constant intensities, the 'maximum' rate (as the intensities increase) increases very rapidly until an intensity of 31.9 foot-candles is reached, then remains constant until an intensity of 182 foot-candles is reached, after which it slowly decreases. If they are subjected to darkness longer than 1 hour, the rate between 31.9 and 182 foot-candles is constant (as it is if they are subjected only 1 hour), but it decreases as the time in darkness increases.

It is concluded that in strong or weak light, the 'maximum' rate of locomotion varies with the intensity and that in moderate light it does not, but that in all intensities it varies with the time in darkness previous to exposure.

138. The avenue of reception of sexually stimulating light in ferrets. T. Hume Bissonnette, Trinity College.

Female ferrets of controlled previous light and sexual histories were subjected to added electric lighting of known sexual stimulating power for considerable periods each day, (a) without hoods, (b) with hoods leaving eyes exposed, (c) with

light-tight hoods. In completely hooded animals failing to remove hoods frequently, light-induced oestrus was delayed significantly, but not in (b) as compared with controls (a). In (c) animals receiving 6 hours of experimental lighting and normal daylight periods upon their bodies only, oestrus was delayed longer than in those without experimental lighting and having their whole heads and bodies partially shielded from light by curtains drawn while hoods were on the (c) animals. In ferrets coming into oestrus from pulling off their hoods, if the hoods were replaced for 3 hours each day pulled off, anoestrus ensued followed by oestrus when hooding ceased with lighting continued.

These facts indicate that the eyes are the receptors for photoperiodic sexual stimulation acting even when lids are closed in sleep. In sexually photoperiodic animals, previous history, as regards light and other environmental factors, should be considered seriously by those who would study experimentally the activities of the sex glands and anterior hypophysis lest conflicting conclusions and confusion result.

139. Modification of serum precipitin reactions by method of injection. Harold R. Wolfe, University of Wisconsin.

Reactions of antisera produced in rabbits against mammalian serum proteins are determined, in part, by the methods of injection. Three injections, totaling 3 cc. of undiluted serum, yield a very specific and high-titered antiserum. Reinjections, 3 months after the last injection, with 1½ cc. of undiluted serum alters the specificity so that 'extra-group' reactions are often as high as 'group' reactions; but reinjections with minute quantities, from 1/10 cc. to ¾ cc. of a 2 per cent homologous antigen, alter the reactions but slightly. Twenty-two rabbits have been injected with serum proteins and have produced specific antisera of high titer when bled 12 days after the last injection. The blood of rabbits, when bled after 2½ months following the last injection, yields a negative antiserum or a low titered one. Reinjections of minute quantities have been made in the rabbits every 3 months over a period of approximately a year and each resulting antiserum is of high titer, with a specificity but slightly different from that of the original antiserum. There was but one exception. Two experiments suggest that an initial injection series totaling 6 cc. of a 2 per cent serum protein solution may yield a precipitating serum of greater specificity than made by any other method of injection.

140. The effect of thyroidectomy on the gonad-stimulating hormone of the anterior pituitary in immature male rats. Kathryn F. Stein and Margaret Lisle, Mount Holyoke College. (Introduced by A. Elizabeth Adams.)

Twenty-one to 28-day-old male white rats were thyroidectomized and after 3 to 6 weeks their pituitaries were injected into thirty-one immature female mice 18 to 20 days of age. Thirty-one littermate female mice received glands of normal male donors, littermates of the thyroidectomized animals. Thyroidectomy almost invariably caused an increase in pituitary weight. Hosts received either one or two pituitary glands and were killed on the fourth day after injection. The ovaries of injected animals showed increase in weight over those of littermate controls, but there was no constant difference in the ovaries whether the animals received pituitaries of thyroidectomized or of normal donors. It

was therefore concluded that the gonad-stimulating potency of the pituitary of the young male rat is very slightly if at all affected by thyroidectomy. This is in agreement with conclusions drawn by Smith and Engle ('30) for female rats and by Smelser ('34) for 4- to 6-month-old males.

141. The behavior of the red cell count of guinea pigs following exposure to low pressures. William Kleinberg and Albert S. Gordon, Washington Square College, New York University. (Introduced by Harry A. Charipper.)

Adult male guinea pigs were subjected for continuous periods varying from 5 to 14 days, to a pressure of 380 mm. Hg. This is sufficient to cause a substantial rise in red cell count. Soon after removal of the animals from the pressure chamber, the red cell counts begin to fall, an anaemia developing which reaches its height about a month later. The extent of this anaemia depends on two factors:

1) The period of exposure—in general, the longer exposures produce greater rises in count followed by greater percentage drops after exposure.

2) The magnitude of the normal red cell count—in animals with low normal counts, the percentage fall below normal after exposure is not as great as in animals with high normal counts.

Following the anaemia, the counts rise and within another month they reach a level above the normal count, but not as high as the one originally attained.

The behavior of the reticulocyte counts throughout the experiment indicates that these rises and falls in the red cell count are due to the respective overfunctionings of the haemopoietic and haemolytic sides of the haemolyto-poietic system.

The excursions of the count above and below normal are still evident 3 months after cessation of the stimulus. They become less marked, however, until, shortly after the fourth or fifth month, the normal count or a figure near this, is maintained.

142. Changes in the red blood cell picture of the rabbit during the development of a tolerance to cyanide. Albert S. Gordon, Washington Square College, New York University. (Introduced by Harry A. Charipper.)

Rabbits were given daily subcutaneous injections of a dose of potassium cyanide sufficient to produce on the first day, a few minutes after its administration, such marked effects as quicker and deeper respiration, slight convulsions, and a backward arching of the head. These responses to cyanide become less intense following the continued daily injections of the same dose, and in about a month, they disappear. Accompanying this development of tolerance is a fall in red cell count, the anaemia reaching its height when the above symptoms following the injection of cyanide are no longer apparent. At this point, the red cell count begins to rise despite the continued daily injections of the same amount of cyanide, and reaches its normal level within another month.

In animals which have developed a tolerance to a particular quantity of cyanide and allowed to recover completely from the anaemia, the daily administration of a larger dose produces the same toxic effects, the external symptoms again disappearing at about the time the anaemia reaches its height.

Work is being planned to determine whether the development of a tolerance to other substances is accompanied by some change in the blood picture.

143. The use of low pressures in the study of the erythrolytopoietic relations of the guinea pig's spleen. Albert S. Gordon and William Kleinberg, Washington Square College, New York University. (Introduced by Harry A. Charipper.)

Normal and splenectomized guinea pigs were exposed to a reduced pressure of 380 mm. Hg for 10 days. At the end of this period the splenectomized animals showed the same increases in red cell count and reticulocytes as the controls. The intensity of response was similar in animals kept 3 to 78 days after splenectomy before being subjected to the low pressures. The view, therefore, that the spleen exerts an influence on the activity of the marrow does not appear substantiated by these results.

In animals exposed to reduced pressures, 3 to 40 days after splenectomy, the count continued to rise despite the cessation of the stimulus. The greatest rises being observed in animals splenectomized 13 to 25 days prior to exposure. No significant rises were obtained in any of the controls.

Data show that the rise in red cell counts of splenectomized animals after exposure are not due to greater activity of the marrow of these animals compared with the controls. In vitro haemolysis experiments, moreover, indicate that these post-exposure rises in the splenectomized animals must be attributed, to some extent, to an increased resistance of the corpuscles.

All animals, however, reach their normal counts in about the same time, because in the case of the splenectomized animals, the system compensating for the removal of the spleen becomes hyperactive.

144. The reduction of methylene blue in nerve cells. Elbert C. Cole, Williams College.

The delineation of a neuron was found to depend upon: a) adequate penetration of the methylene blue solution into the cell; b) the reduction of the dye by cellular activity; and c) subsequent re-oxidation or 'bluing' of the cell. Re-oxidation could be accomplished by: 1) exposure to atmospheric oxygen; 2) destruction of the reducing mechanism of the cell; or 3) by a combination of methods 1 and 2. The utility of the process was found to be sharply limited by the fact that bluing must be accomplished without injury to the cell within the limits of microscopical observation.

Strong solutions of methylene blue in physiological saline destroyed cells promptly and general staining of various types of cells resulted. Selective staining was accomplished by the use of concentrations low enough to allow the reducing action of the cell to proceed. Different portions of the nerve cell showed variations in reducing power as well as differences in resistance to observable destruction.

The cell body reduced the dye vigorously, but since it was extremely sensitive to toxic factors, it was only within narrowly limited conditions that the cell body could be made to stain selectively. The axon also reduces methylene blue, but its sturdier construction permitted the use of higher concentrations of the dye without serious injury to the microscopic picture. The reducing capacity of the motor end plates could not be determined conclusively. They did show, however, a high resistance to destruction after prolonged staining with strong dye solutions and free exposure to air.

EVOLUTION

Read

145. Can artificial selection produce unlimited change? H. D. Goodale, Mount Hope Farm. (Charts; 15 min.)

The prototype of the theory of the origin of species by natural selection was found by Charles Darwin in artificial selection as practiced by breeders of domestic animals. It was held that the accumulation of small continuous variations would, in the end, produce not only new forms but a new inheritance. This view, once accepted by biologists, was scarcely challenged until the beginning of the twentieth century. As the science of genetics developed, this view was replaced by the view that selection is powerless to create new inheritance, and that the changes produced by selection represent only a rearrangement of the inheritance already existing in the population except as the discontinuous and unpredictable changes called mutations occur. However, experimental evidence exists that the power of artificial selection to produce change is much greater than is generally believed by geneticists. Thus Darwin's view that selection has power to create as well as rearrange inheritance finds support and may eventually regain its former standing as a factor in organic evolution.

146. Genetics and animal relationship. Alan Boyden, Rutgers University. (Lantern; 15 min.)

Genetic facts and principles bear directly upon genetic relationship. A critical analysis of the principles of phylogeny and taxonomy from the viewpoint of genetics is long overdue. The generally accepted principles of phylogeny and taxonomy may be briefly stated as follows: 1) all animal relationship is genetic; 2) animal relationship is and should be determined chiefly by morphological comparison of fossil, developmental or adult structures; 3) the central concept of comparative morphology is homology, and genetic relationships are clear in proportion as homology can be determined; 4) the proper basis of comparison in the analysis of racial descent is the whole individual during its whole life cycle; within this unit only corresponding stages may be compared; 5) the most conservative characters have greatest value as guides to kinship; 6) the goal of taxonomy is the expression of phylogenetic relationships. From the standpoint of genetics principle (1) is axiomatic if evolution is accepted. Principle (2) should be broadened to include all types of hereditary characters and to exclude non-inherited characters. Principle (3) is fundamentally sound for homology has a solid genetic foundation in that corresponding organs of the bodies of related animals are each dependent upon the interaction of many similar hereditary factors derived from common ancestry. Principles (4), (5) and (6) require only slight modification. On the whole genetics affirms the validity of these principles but the suggestion of de Vries that systematic relationship is proportional to the number of identical common genes can be of but limited help in phylogeny.

147. A NATURALISTIC DEFINITION OF LIFE. F. H. Pike, Columbia University. (10 min.)

Some mathematicians and physicists, e.g., Hobson, "The Domain of Natural Science," have doubted whether biology could be brought wholly within the domain of natural science.

To achieve this, the biologist must exclude animism. In the equation—

$$L = f(E)(PC)(G)(N)$$

in which L is life, E the total environment, PC the physicochemical basis of the organism, G the endocrine system and N the nervous system, life is expressed as a function of four variables, which exclude animism, entelechy or teleology.

We must show that some natural relation exists between E and the other variables such that the principle of entropy holds.

We must show that the last three variables are not independent variables (N sometimes being regarded as independent) to account for adaptation; and that the equation will account for evolution as well as for individual maintenance.

The laws of thermodynamics have been shown to hold in so many places in the description of processes in the individual that one may venture the opinion that the equation will eventually be of the thermodynamic form, in part.

The main problem is to determine whether thermodynamics alone will account for photosynthesis, or whether some other field of physics—quantum mechanics or quantum electrodynamics—will become necessary.

CYTOLOGY

Read

148. CYTOLOGY OF THE WHITE BODY OF LOLIGO. Hope Hibbard, Oberlin College. (Lantern; 10 min.)

The white body, a cushion of soft material behind the cephalopod eyeball, has been homologized with vertebrate lymphatic organs (Faussek). It is made of a stroma or net of fibers with more or less loose cells packed into its meshes. These fibers have been variously described as intercellular strands like those of loose connective tissue (Carrazzi), or as slender prolongations of stellate cells (Kollmann). This study, by means of cultivating these bodies in vitro, by vital staining as well as the usual staining methods on sections, compares white body cells with masses of cells centrifuged out of the circulating blood and treated similarly. It shows clearly the identical nature of the cells. Fragments of white body, or of blood clot, mounted in centrifuged plasma, show similar cells migrating rapidly over the coverslip, extending long delicate processes. A definite group of neutral red vacuoles lies distal to the nucleus and minute fat droplets may be found in any part of the cells. After several days the fat increases noticeably in amount. In cultures several days old the cells show long connecting strands which are the shrunken remains of original pseudopodia, and probably correspond to the stroma of the white body itself. The chondriosomes appear as granules or short rods and are abundant among the neutral red vacuoles. Extreme variability in nuclear shape is likewise similar in blood cells and white body cells. The white bodies, however, contain, in addition, muscles which will contract for many hours in vitro.

149. The lateral-line organs in the terrestrial red-eft stage of the newt, Triturus viridescens. Alden B. Dawson, Harvard University. (Lantern; 8 min.)

The lateral-line organs of aquatic larval, terrestrial red-eft and aquatic adult stages are compared. In the larva, the organs are superficial, almost entirely at the level of the epidermis and the tips of the sensory cells lie exposed on the surface. During the terrestrial stage the organs lie deeper in the dermis, and are completely separated from the free surface by an overgrowth of epidermal cells. Both the sensory and supporting cells are partially dedifferentiated but easily recognized as they retain their normal positions.

In the adult stage the organs are large and lie deep in the dermis. The free ends of the sensory cells usually lie at the base of a canal formed by the distal ends of modified supporting cells. During the transition from land to water the sensory and supporting cells reacquire their definitive differentiation and as the organs increase in size mitoses of both sensory and supporting cells are common.

150. Studies by means of tissue transplants on the color patterns of tropical marine fish. H. B. Goodrich, Wesleyan University. (Lantern; 10 min.)

Tissue exchanges (autoplastic scale transplants) have been made between differently pigmented areas of marine coral reef fish. The types used were Halichaeres bivittata (Bloch) and Thalassoma bifarciatus (Bloch) and the observations were made at the Tortugas Laboratory of the Carnegie Institution of Washington during the summer of 1935. In Halichaeres transplants between dark and light horizontal stripes showed that in the new location the tissue gradually attained the color characteristics of the surrounding tissue. On the other hand similar experiments made on the Thalassoma showed little or no change of the transplanted tissue. In this latter case the exchanges were made between the vertical blue, green, and black stripes or areas. Homoplastic transplants have uniformly failed. Data are presented in regard to the cellular constitution of differently pigmented areas.

151. A study of the megakaryocyte and blood platelet in the rat. Christianna Smith and Jean Hastings. Mount Holyoke College. (Lantern; 10 min.)

For the study of the staining reactions of the megakaryocyte, suspensions of bone marrow in serum were made according to the method of Isaacs. Blood and bone marrow from the same animal were smeared on one slide so that platelets and megakaryocytes would be in the same staining solutions. Azurophilic granules were particularly clear in a combination of Wright's stain and Giemsa. Positive oxydase reactions were obtained in both platelets and megakaryocytes with the benzidin-polychrome, copper-benzidin and dopa methods.

152. The use of trypan blue in detecting cell death in the perfusion of the mammalian kidney, and the evaluation of some modified Ringer-Locke fluids by this method. J. M. Darlington, Brown University and Scranton-Keystone Junior College. (Introduced by A. D. Mead.) (Lantern; 10 min.)

Modified Ringer-Locke fluids were perfused through a mammalian organ and an evaluation of the adequacy of the fluids as environmental media was attempted by the subsequent perfusion of a vital dye, trypan blue.

Rabbit's kidneys were perfused with four modified Ringer-Locke fluids graded with respect to their theoretical adequacy. Perfusion was performed with each of the four types of fluids for periods of ¼ hour, ½ hour, 1 hour, 1½ and 2 hours.

The four fluids employed were: Ringer-Locke, Ringer-Locke plus gelatin, Ringer-Locke plus beef red blood cells, and Ringer-Locke plus gelatin plus beef red blood cells. These were followed (in each case) by an additional 10-minute perfusion of 1-4000 trypan blue in Ringer-Locke.

The distribution of trypan blue following perfusion was studied in section fixed in Susa; the general cytological aspects of the cells were studied in sections fixed in Champy and stained with iron haematoxylin.

The amount of tissue stained with trypan blue varied in accordance with the theoretical adequacy of the fluids and the length of perfusion. The reaction of the dye furthermore paralleled the pathological changes of the mitochondria.

It is concluded that the use of trypan blue following a perfusion can serve as a practical criterion of the adequacy of the perfusion fluid.

153. Abnormal nuclear phenomena in 3-week kittens' ovaries. Elizabeth Sneider, Brown University. (Introduced by A. D. Mead.) (Lantern; 10 min.)

A cytological study was made of the ovaries of fourteen 3-week-old kittens, obtained from various sources. At this age meiotic prophases are abundant. In all cases some oogonia and oocytes were found with abnormal nuclei.

Cells were found with: 1) bipolar spindles in early anaphases and metaphases with varying numbers of chromosomes distributed along the spindle; 2) bipolar spindles with chromosomes left off the spindle; 3) tripolar prophases—leptotene, diplotene, pachytene, etc.—metaphases and telophases; 4) five and seven spindle figures; 5) polynuclear cells containing from one to five nuclei which were usually oriented to one idiozome. In addition, there were found cells with vacuolated cytoplasm and clusters of cells having pycnotic nuclei.

It appears that some interference with the normal division occurs at this time that results in cells which degenerate because they receive an abnormal chromatin content.

154. The cytology of the hypophysis cerebri of the bat, Myotis lucifugus lucifugus. Elizabeth L. Sawyer, University of Missouri. (Introduced by Mary J. Guthrie.) (Lantern, charts; 15 min.)

A cytological study of the hypophyses of more than 100 female bats, collected at fortnightly intervals from October to April, is reported. The bats were decapitated within 24 hours after collection, and the hypophyses fixed in Champy's

fluid or Helly's fluid, followed by staining by the acid fuchsin-thionin-aurantia method of Kull. The pars distalis, pars intermedia, and pars nervosa lie adjacent to one another in the flattened gland. In some hypophyses the lumen of the original buccal evagination persists as a narrow residual cleft, which may be expanded to form ciliated vesicles. Observations on cell size, nucleoplasmic ratio, degree of chromaticity in the nucleus, staining reactions of the cytoplasm and secretory granules, and the presence of chondriosomes, secretory granules, and vesicles in the cytosome are reported. Secretory cells and histiocytes are identified. Secretory cells of a single type are found in successive stages of growth, differentiation, secretion and degeneration. Cells which have discharged their secretion apparently do not resynthesize secretory granules. Mitosis is not observed. The available evidence suggests utilization of a large supply of embryonic cells as the source of the fully differentiated cells. The cells of the pars intermedia are interpreted as potential secretory cells, which do not differentiate under the inadequate nutrient conditions of that region.

155. The cytology and function of hepatic cells of the chick embryo in chorio-allantoic grafts. Albert J. Dalton, Western Reserve University. (Lantern; 15 min.)

Hepatic cells in chorio-allantoic grafts give evidence of functional activity prior to the time at which it becomes obvious in normal ontogeny (on the eleventh day of incubation). Functional activity in grafts first becomes evident during the latter part of the eighth day when absorptive activity of the definitive hepatic cells is first indicated by the appearance of minute droplets in the cytoplasm, and secretory activity is first indicated by the appearance of products of secretion in the bile ducts as demonstrated in post-osmicated material.

Up to the eighth day mitochondria appear as characteristic, wavy, tenuous filaments. During the ninth day they change to spheres and short rods in certain of the cells. On the ninth day all of the mitochondria have the form of short or long, curved or straight rods.

An important event in the history of the Golgi network is considered to be the shift from its juxtanuclear position to one nearer the distal end of the cell. The shift is completed just before the first observable indication of functional activity may be noted in the grafts. This change may prove to be an indicator of the onset of function in the hepatic cells of the chick. Other changes, such as the later expansion of the Golgi network, do not suggest any association with cytogenesis.

156. The chromoplast of Orthopteran germ cells. H. Irene Corey, University of Pennsylvania. (Introduced by C. E. McClung.) (Lantern; 15 min.)

As reported in 1933, there occurs occasionally in Orthopteran germ cells a large deeply staining structure very similar in appearance to the chromoplast of Eisen and Janssens. Under appropriate techniques it was shown in Stauroderus scalaris to be constituted of the fused proximal ends of the chromosomes. Six species from two other Orthopteran subfamilies, studied in the present paper, likewise possess chromoplasts varying in degree of integration and concentration of the polar granules, which serve as indicators of chromosome movements in the growth

stages. The evolution of the chromoplast through three Orthopteran subfamilies is traced. It appears to be analogous to the chromocenter of the salivary gland chromosome complex.

157. Organization of dipteran salivary gland chromosomes. C. W. Metz, Carnegie Institution of Washington and Johns Hopkins University. (Lantern; 15 min.)

Studies on internal structure of salivary chromosomes in Sciara and Drosophila, including earlier observations of Doyle, Gay and the writer, are summarized and illustrated, and current hypotheses as to nature of these chromosomes are discussed. Especial attention is given to comparative study of effects of different fixatives and to conditions in living chromosomes. Following are among features emphasized.

With acetic fixation great shrinkage of chromosomes occurs and chromatic cross bands tend to be granular; with formalin there is less shrinkage and bands tend to be continuous or smooth and apparently more like those in living, slightly shrunken chromosomes. Acetic coagulation gives distinct honey-comb or alveolar network in achromatic material of chromosomes. In relaxed chromosomes no longitudinal or spiral striations are evident in our material. Such striations, seen in stretched or twisted chromosomes, appear to be due partly to formation of ridges on surface and partly to distortion of internal honey-comb network. Number of 'granules' in cross bands differs in different bands and varies with fixative used. Superficial appearance of constancy may be produced in greatly stretched chromosomes by the surface ridges which group smaller granules in line with larger ones.

Cross 'bands' appear to represent discs not rings. Longitudinal striations are not considered to represent separate threads or chromonemata as postulated by several investigators. Differences in type of coagulation in achromatic materials at different levels along chromosome are interpreted as indicating corresponding chemical differentiation and possible genic nature of achromatic constituents.

158. A comparative study of chromonemata in Trillium erectum L., Tradescantia reflexa Raf. and Dissosteira carolina L. B. R. Nebel and M. L. Ruttle, New York State Agricultural Experiment Station. (Introduced by F. Schrader.) (Lantern; 15 min.)

Mitosis in Trillium and Tradescantia is essentially alike: At metaphase four chromonemata are visible in each half chromosome. At ana-, telo- inter-, and prophase the chromosome thus consists of four threads conveniently called half-chromatids. The threads are coiled separately, lie approximately parallel to each other and are held together at the insertion region. Earliest prophase unites half-chromatids by shoving them together gyre for gyre, spiral prophase approximates chromatids in the same way. Mitosis accordingly contains two pairing stages.

In Tradescantia and Trillium the meiotic cycle thus commences with four chromonemata per chromosome. In Dissosteira, on the other hand, only two threads per chromosome are visible. Diatene pairing, obvious in Dissosteira, is not marked in Trillium and Tradescantia. Leptotene elongation of entire chromosomes in Dissosteira leads directly to the intimate synapsis of homologous chromosomes. In Trillium and Tradescantia the elongating threads of preleptotene are

chromatids. Leptotene unites sister chromatids; after these have 'synapsed' true synapsis between homologous chromosomes begins. Crossing over in these plants must then involve four visible units at each point 2 and 2 acting as a unit. Interkinesis shows eight threads in each univalent, second telophase four. In Dissosteira only four and two threads, respectively, can be seen at these stages.

159. Cytological observations on the gall wasp Neuroterus lenticularis (Spathegaster baccarum): Hymenoptera. Kenneth S. Dodds, Durham University, Armstrong College, England. (Introduced by Fernandus Payne.) (10 min.)

Prophases of maturation divisions in agamic females of Neuroterus lenticularis (Olivier) and sexual females of the alternate generation Spathegaster baccarum (Linn.) have been studied to elucidate the synaptic phenomena associated therewith. No double synapsis, as described by Hogben in Rhodites rosae (Htg.) and Cynips Kollari (Htg.), has been observed. It is suggested that apparent telosynapsis in bivalents after the diffuse state is brought about by repulsion between previously parasynaptically paired chromatin threads with terminal spindle-fiber attachments and complete terminalisation of chiasmata.

Observations on the maturation and segmentation of eggs of N. lenticularis confirm Doncaster's statement that one kind of parthenogenetic female lays eggs which undergo no reduction division while a second kind lays eggs which do undergo this division and show the reduced number (ten) of chromosomes. Contrary to Doncaster's description, it seems that only one maturation division occurs in the latter type of egg. Of the two resulting groups of chromosomes, the inner sinks into the egg and forms the egg nucleus, while the outer divides again to give two groups of polar chromosomes. The haploid-diploid ratio is not maintained consistently in male and female adult tissues of the sexual generation.

In the spermatogenesis of Spathegaster baccarum the nucleus undergoes a resting period with dispersed chromatin, between the abortive first and equational second division. No cytoplasmic bud is nipped off as described by most workers in Hymenoptera.

By demonstration

160. A comparative study of chromonemata in Trillium erectum L., Tradescantia reflexa Raf. and Dissosteira carolina L. B. R. Nebel and M. L. Ruttle, New York State Agricultural Experiment Station. (Introduced by F. Schrader.)

See abstract no. 158.

161. The cellular constituents of the islets of Langerhans of mammals. Thurlo B. Thomas, Harvard University. (Introduced by Alden B. Dawson.)

See abstract no. 164.

162. A chromosome (tetrad) model for use on the lecture desk in the explanation of segregation (reduction). Manton Copeland, Bowdoin College.

No abstract received.

163. Selective staining of nervous and non-nervous tissues with methylene blue, and the making of permanent mounts. Elbert C. Cole, Williams College.

A demonstration of prepared slides. No abstract received.

By title

164. The cellular constituents of the islets of Langerhans of mammals. Thurlo B. Thomas, Harvard University. (Introduced by Alden B. Dawson.)

In 1931 Bloom demonstrated a new type of granular cell (D cell) in the islets of Langerhans of man by means of Mallory's azan technique following Helly fixation. By substituting methyl blue for anilin blue, but otherwise employing the same technique as a standard procedure, it has been possible to demonstrate this new type of granular cell in the islets of all of the fifteen different species of mammals thus far studied. The normal mammalian islet appears, therefore, to be composed of the well-known A and B cells, and the D cells of Bloom. Only in the guinea pig have the 'undifferentiated cells' of Bensley (type C) been demonstrable. Final proof that the D cells are really a distinct type, and not a physiological condition of the A or B types giving a different color reaction, must depend on the extension of the present survey and the completion of experimental work in progress.

165. The activation of the embryonic thyroid of the chick by means of thyrotropic hormone of the anterior pituitary. Gilbert L. Woodside, Harvard University. (Introduced by Alden B. Dawson.)

Thyrotropic hormone (Collip) was injected into chick embryos and the effects on the thyroid noted. The embryos used ranged in age from 8 to 18 days of incubation. An opening was made in the shell and outer shell membrane in the region of the air sac. Then the needle was inserted through the inner shell membrane and allantois and the hormone injected directly into the embryo.

Completely activated thyroids, as shown by the presence of high epithelia and by the absence of colloid, can be produced in less than 24 hours by direct injection. Equivalent or larger quantities of the hormone are ineffective when placed in the air sac for the same length of time or for longer periods. Under these conditions the thyroids remain normal.

Prolonged direct injections of thyrotropic hormone result in a renewal of colloid storage and a lowering of the epithelium. In embryos which have received injections twice daily from the ninth to the seventeenth or eighteenth day of incubation the thyroids have returned to the condition found in the controls.

166. Crustacean eye-stalk hormone and the migration of the retinal pigments. Louis H. Kleinholz, Harvard University. (Introduced by Alden B. Dawson.)

The crustacean eye-stalk hormone is known to cause concentration of the body chromatophores. The effects of eye-stalk extracts, prepared from a number of decapod crustaceans, were tested on the retinal pigments of Palaemonetes vulgaris. Test specimens, which had been adapted to light, showed no response of the distal pigment to stalk extract injections. Animals adapted to darkness, when injected

with extracts prepared from the eyes of crustaceans adapted to light, responded with a migration of the distal and the reflecting pigments into the position characteristic for a light-adapted eye.

167. The effect of excess cholesterol on the vacuome in nerve cells of fish. Ross C. MacCardle, Temple University.

The effect of excess cholesterol on the vacuoles in nerve cells of Carassius auratus was observed during a series of studies in progress designed to correlate changes in cytoplasmic structure with some functional changes (such as changes in fat and water content). Four cc. of a 1 per cent solution of cholesterol was injected intraperitoneally daily for 20 days. Cytological preparations were made by the following methods: Dietrich, Cajal, living cells stained with neutral red and subsequently fixed with osmic acid vapor according to Covell and Scott.

The cytoplasm in nerve cells of normal animals contains relatively few clear vacuoles, found mainly near the nucleus (Dietrich, Cajal preparations). Neutral red granules appear throughout the cytoplasm.

After injection of excess cholesterol (chemical analysis of whole brains of injected animals showed an increase in cholesterol content from 1.5 per cent in the normal to 2.4 per cent in the injected animal; and an increase in water content from 88 per cent in the normal to 91.5 per cent in the injected animal), clear vacuoles and neutral red granules increase in number. The vacuoles seem to have coalesced to form large watery vesicles.

It would be valuable to know the correlation between cerebrospinal and brain pressures and the cholesterol content, since cholesterol seems to be a factor in regulation of water content. Further experiments are being carried out on mammalian tissue.

168. Histological changes accompanying the growth of the mid-intestine of Japanese beetle larvae. Daniel Ludwig and W. Fulton Abercrombie, New York University.

A study was made of the changes in the mid-intestinal epithelium which occur during the growth of first and second instar Japanese beetle larvae. Measurements and counts of the columnar cells were made in the region limited by the second and third rings of gastric caeca.

During the first 4 days of each instar (at 25°C.) there is no increase in the number of columnar cells, growth being due entirely to an increase in the size of cells already present. The number of columnar cells begins to increase about the fifth day of each instar and continues to increase until the larva prepares for the succeeding molt. New columnar cells are produced by a division and differentiation of the basal or interstitial cells. The new cells become elongated and push between adjacent columnar cells. They continue to grow until they have reached the size of columnar cells already present. Cell multiplication and differentiation occur simultaneously and most rapidly near the end of each instar.

PROTOZOOLOGY

Read

169. The occurrence of the avian malarias in nature. Reginald D. Manwell, Syracuse University. (Lantern, charts; 12 min.)

A total of 700 wild birds have been examined, belonging to forty-four species. Subinoculation has been done in 150 cases, and blood examination of stained films in all. Nearly all the birds were trapped, and most of them were caught in or near Syracuse, N. Y. The results have shown malaria infection to be very common, but it has been found to vary much in different species of hosts. All the adult robins examined and two-thirds of the song sparrows carried malaria parasites—often of more than one species. Juncos, on the other hand, were not often found infected, and the reason is believed to be that they have a more northern range. Since non-migratory birds, such as the English sparrow and starling, are also seldom infected, and since this is also true of young birds (e.g. robins) it is believed that infection with malaria is generally acquired in the southern portion of the range of migratory species. If this is true, the habit of migration has the effect of protecting birds against such insect-borne diseases as malaria during the breeding season, as well as aiding in securing an adequate food supply and other advantages. So far eight different species of malaria parasites have been found, of which Plasmodium praecox, cathemerium, circumflexum and elongatum seem to be most common. Plasmodium vaughani is very frequent in robins, however, and polare is fairly often found in cliff swallows. P. hexamerium has so far been found only in a Maryland yellowthroat and nucleophilum in a catbird.

170. Life cycle of Endamoeba blattae (Bütschli 1878). Samuel Morris, Temple University. (Introduced by D. H. Wenrich.) (Lantern; 15 min.)

Prolonged study of the form and life history of Endamoeba blattae (Bütschli, 1878) indicates that:

1. The mitotic picture described by Janicki ('09) for the adult and precystic stages is essentially correct.

2. Excystation and concurrent morphological transformation give rise to small amoebae indistinguishable from, if not identical with, Endamoeba thomsoni Lucas 1927.

3. Mitotic stages of these post-encystment animals contain fewer (probably half) the number of chromosomes found in the divisions before encystment.

4. Nuclear division is unusual in both cases, in that the chromatids have already separated when they take form in the prophase and are segregated to the poles without formation of a true metaphase.

It is believed that the above facts, taken together, constitute evidence favoring the probability of origin of the large adult E. blattae by copulatory fusion of two of the smaller post-encystment animals.

171. The relation of endomixis to vitality in Paramecium aurelia. T. M. Sonneborn, Johns Hopkins University. (Introduced by H. S. Jennings.) (Charts; 15 min.)

The usual inter-endomitic period in many stocks of Paramecium aurelia is 25 to 35 days; in other stocks, 13 to 18 days; but in all stocks there is much variation in the extent of the period. When many isolation lines descended from one ex-endomitic are cultured, some of them fail to go through any further endomixes. Such lines maintain their high vitality for about 150 generations, during a time equal to several average endomitic periods. Thereafter, they gradually decline in fission rate until they ultimately die. Death occurred 300 to 350 generations (139 to 165 days) after the last previous endomixis. In sister lines which went from the start through regularly repeated endomixes, there was no indication of decline in vitality. Among other sister lines which went through endomixis after long omission of endomixis had greatly lowered the fission rate, many died at once, others suffered an immediate and permanent reduction in fission rate, and others were unaltered in fission rate. But some had their original high vitality restored at once; lines long depressed returned to rapid multiplication after endomixis. These lines, and also those whose fission rates had been unaltered or lowered by endomixis, continued to live and multiply after their depressed non-endomitic sister lines died out.

172. A comparative study of the contents of the gelatinous accumulations of the culture media and the contents of the cytoplasm of Amoeba proteus and Arcella vulgaris. E. DeWitt Miller, University of Virginia. (Introduced by H. E. Jordan.) (Lantern; 10 min.)

Comparative data give the basis for reinterpreting alleged chromidia, mitochondria, and Golgi material described for certain rhizopods.

Three distinct groups of granules can be demonstrated in both Amoeba and Arcella by techniques ordinarily employed for demonstrating chromatin elements of a cell, mitochondria or Golgi material. With respect to physico-chemical properties the granules appear identical with certain forms of bacteria in the culture media. They are not destroyed by alcohol, ether, or 5 per cent acetic acid; although in some cases their ability to stain is altered much in the manner of bacteria of similar morphology found in the culture media.

These granules are apparently bacteria; two groups representing permanent cytoplasmic inclusions either as symbionts or commensals, the third possibly temporary invaders.

None of the cytoplasmic inclusions of these rhizopods have given the characteristic mitochondrial reaction when treated with Janus green. Spherules and granules observed in Amoeba blackened with osmic acid can be revealed by techniques ordinarily employed for demonstrating the chromatin elements of a cell. Similar spherules and granules occur in the gelatinous material of the culture media either free or in bodies similar to those sometimes found in food vacuoles.

In Arcella, neutral red-stainable and osmiophilic bodies, apparently identical with granules or small globules found individually distributed in the cytoplasm, can be observed both in food bodies in food vacuoles and in similar food organisms in the medium. Those occurring in the cytoplasm may represent indigestible material discharged into the cytoplasm.

173. The behavior in mitosis of the karyosome and so-called peripheral chromatin in Amoeba proteus. H. W. Chalkley, National Institute of Health. (Lantern; 15 min.)

A comparison of preparations stained with Weigert's haematoxylin and with Feulgen's stain shows that contrary to the commonly accepted view the granules of chromatin (sic.) that lie in interkinesis just beneath the nuclear membrane play no part in the formation of the chromatin of the equatorial plate, but break down during the prophase. They contain at best merely traces of nucleic acid. It is possible that these peripheral granules give rise to, or contribute to, the formation of the spindle fibres and the pole caps. The chromatin granules of the plate arise entirely from the karyosome.

Demonstration

174. Chart of taxonomic relationships of free-living amebas. A. A. Schaeffer, Temple University.

About 100 species of amebas are drawn to scale, showing the general outline of body form and the characteristics of the nucleus as it appears in the living ameba. The amebas are arranged in their most probable taxonomic relationship. Many species of amebas could not be included in the chart owing to lack of published sketches of general body shape during locomotion and of nuclei in the living amebas. About three-fourths of all described free-living amebas are shown on the chart. This number is not quite one-half of all generally recognized species.

About a dozen of the following species of amebas are on exhibition on the microscopes: Pontifex horridus, Pontifex maximus, Cochliopodium gulosum, Flabellula citata, Flabellula mira, Mayorella bigemma, Mayorella conipes, Vexillifera aurea, Polychaos dubia, Chaos diffluens, Metachaos discoides, Metachaos fasciculata, Rugipes bilzi, Thecamoeba rugosa, Trichamoeba clava, Endamoeba blattae.

174A. A comparative study of the contents of the gelatinous accumulations of the culture media and the contents of the cytoplasm of Amoeba proteus and Arcella vulgaris. E. DeWitt Miller, University of Virginia. (Introduced by H. E. Jordan.)

See abstract no. 172.

By title

175. The Folliculinidae (Infusoria heterotricha) of the British coast. E. Fauré-Fremiet, Collège de France, Paris.

In the infusorian fauna of Concarneau the family Folliculinidae is represented by fifteen different species. Each of them has been studied in a living state. The author proposes the creation of the genus Folliculinopsis for the species endowed with a beaded macronucleus, the primitive generic denomination of Folliculina being kept for species with a single ovate macronucleus.

Two new species, F. annulata and F. lignicola are described; and the description of the other species is the occasion for a revision of the whole group.

176. The bean-seed infusion as a culture medium for paramecia. Elbert C. Cole, Williams College.

Cultures prepared with 'yellow eyed' beans showed characteristics which differed from those of the conventional hay infusion in the following respects: 1) the curve of population density; 2) the curve of hydrogen-ion concentration; and 3) the nature of the bacterial flora.

Bean-seed infusions permitted an extremely dense population to develop. There appeared to be a fairly definite optimum relation between surface area and volume of a culture. Contrary to expectations, cultures with a 1: 10 surface-volume ratio did not thrive so well as those having a 1: 30 ratio. Beans were either sterilized by boiling for 2 minutes, or placed directly in water without such treatment. One bean per 50 cc. of water and one bean per 100 cc. of water are two proportions that gave satisfactory results. In all cases beans were cut transversely to expose the interior of the cotyledons, and cultures were 'seeded' with paramecia immediately after preparation. The bacterial flora formed a gelatinous mass which restricted the locomotion of the animals. Consequently this type of culture proved to be very useful for the study of living paramecia under high magnification.

177. Relation of hydrogen-ion concentration to growth and encystment of Entamoeba histolytica in cultures. Gladys M. Craig, New York University. (Introduced by R. P. Hall.)

Using Sörensen's phosphate buffers, different lots of Cleveland's medium for E. histolytica were prepared with initial pH ranging from 8.3 to 6.0, and then inoculated with a 'non-encysting' strain of E. histolytica (Cornell strain no. 370). Maximum growth was observed in cultures with an initial pH of 7.4 to 7.6, while good growth occurred with the initial pH ranging from 7.4 to 8.3. Growth was poor with initial pH from 6.6 to 6.2, and at 6.0 no living amebas were observed at 48 hours. A shift in pH to 7.0 was observed in every case except cultures with an initial pH of 6.2 or lower. Cysts were observed, after 48 hours of incubation, in cultures with an initial pH of 7.2 to 8.3, whereas encystment had not been observed in Cleveland's unbuffered medium. Both buffered and unbuffered media have been inoculated from the same stock culture, and cross-inoculations have been made from buffered culture to unbuffered medium and from unbuffered culture to buffered medium. Encystment occurred regularly in the buffered, but not in the unbuffered medium.

As indicated by the results of continued transfers throughout a period of several months, the present modification of Cleveland's medium is far superior, for the Cornell strain no. 370, to the standard medium as formulated by Cleveland (Cleveland and Collier, '30).

178. Effects of alcohol on the growth of flagellates and ciliates in bacteria-free media. J. B. Loefer and R. P. Hall, New York University.

The effect of ethyl alcohol (0.025 to 5.0 per cent) upon growth of each of the following species was determined: Chilomonas paramecium, Chlorogonium elongatum, Euglena gracilis, Euglena deses, Astasia sp., Colpidium campylum, Glaucoma

piriformis and Paramecium bursaria. All experiments were carried out with bacteria-free cultures. Growth of Euglena gracilis was accelerated by concentrations of alcohol ranging from 0.025 to 1.0 per cent, and that of Euglena deses by 0.05 and 0.1 per cent alcohol. In the remaining species, there was no evidence for acceleration of growth by alcohol.

179. Growth characteristics of Paramecium bursaria in bacteria-free cultures. John B. Loefer, New York University. (Introduced by R. P. Hall.)

Growth of a bacteria-free strain of Paramecium bursaria in a 0.5 per cent peptone medium was accelerated by 0.5 per cent concentrations of dextrose, mannose, maltose, dextrin, melizitose, starch and salicin. Levulose and galactose were distinctly less favorable, while results obtained with arabinose, xylose, rhamnose and inulin were negative. The optimum for growth in a 1.0 per cent peptone medium was about 6.7 to 6.8, and growth was restricted to the pH range, 5.9 to 7.4. Addition of various salts to this medium tended to raise the optimum and to restrict the growth range to narrower limits. Na_2SO_3 in concentrations greater than 0.01 per cent was toxic, and sodium acetate cultures at pH 6.8 showed no more growth than the controls. Yeast extract in 0.5 per cent solution was not favorable to growth, although in lower concentrations acceleration of growth was noticeable. KNO_3 and NH_4Cl were unfavorable to growth of the ciliates.

180. Growth characteristics of the symbiotic alga from Paramecium bursaria. John B. Loefer, New York University. (Introduced by R. P. Hall.)

The alga symbiotic in a bacteria-free strain of Paramecium bursaria has been isolated and grown on Difco starch agar and nitrate agar slants. The algae apparently utilize organic nitrogen only in the presence of a suitable carbohydrate (e.g., starch), and inorganic nitrogen is required in the absence of a suitable carbon source. In a peptone medium containing mineral salts (KNO_3, KH_2PO_4, $MgSO_4$, $FeSO_4$) good growth of the algae occurred from pH 6.8 to 8.3, while Paramecium bursaria containing the algae failed to grow above 6.8. The results of experiments in progress indicate that conditions favorable to the algae may be detrimental to P. bursaria, while conditions most favorable to the syndicate may not be at all optimal for the algae.

181. Fermentation of carbohydrates by Glaucoma, and effects of carbohydrates on growth of two species. David F. Johnson, New York University. (Introduced by R. P. Hall.)

Glaucoma ficaria has been compared with G. piriformis (Hetherington strain) with respect to fermentation of carbohydrates. The sixteen carbohydrates tested were added separately to Difco phenol-red broth. The following were fermented by G. piriformis: soluble starch, dextrin, maltose, dextrose, levulose, and galactose (the last very slowly, however). With G. ficaria, fermentation of the following occurred: soluble starch, dextrin, maltose and dextrose; in addition, there was a very slow fermentation of galactose.

Growth of both species was accelerated by several carbohydrates—soluble starch, dextrin, maltose, sucrose, dextrose and levulose—and also by mannite. In addition, growth of G. piriformis was accelerated by mannose, melizitose and rhamnose. In the case of G. ficaria, there was no acceleration by melizitose or rhamnose, and mannose produced a distinct decrease in growth as compared with sugar-free control cultures. Inulin seemed to be toxic for both species.

182. Isolation and growth of Glaucoma ficaria in bacteria-free cultures. David F. Johnson, New York University. (Introduced by R. P. Hall.)

A strain of Glaucoma ficaria has been isolated in bacteria-free cultures by the method of Parpart ('28), and has been maintained for the past 2 years in a Difco tryptone medium. Growth of this species has been compared with that of Glaucoma piriformis (Hetherington strain). In our tryptone medium, good growth of G. ficaria occurred within the range pH 4.5 to 7.3, with maximum growth between 4.8 and 5.5. In the same medium, the range for G. piriformis was 4.8 to 8.0, with an optimum between 5.4 and 6.6. The three most satisfactory media for both species were found to be those containing Difco tryptone, Difco proteose-peptone and Difco Bacto-liver, respectively; the liver medium was best for G. ficaria, and the tryptone medium for G. piriformis. Less satisfactory media were those containing Difco neopeptone, protone, and veal, respectively. Poor results were obtained with Difco Bacto-peptone, gelatin, Bacto-hemoglobin and casein. The results indicate definite differences between Glaucoma and Colpidium (Elliott, '35) with respect to utilization of various proteins and peptones.

183. Growth of Glaucoma ficaria in cultures with single species of other microorganisms. David F. Johnson, New York University. (Introduced by R. P. Hall.)

Glaucoma ficaria was grown successfully in suspensions of twenty-one species of living bacteria, one species of live yeast and one alga; in suspensions of eleven different species of dead bacteria, two species of killed yeast and six species of dead flagellates. Since G. ficaria may obtain food saprozoically, suspensions of all food organisms were prepared in a non-nutritive salt solution. Under such conditions, the pathogenic types of bacteria used apparently produced no toxic effects on the ciliates. The availability of yeast and small protozoa as food for G. ficaria depended largely upon the size of such organisms, the larger forms not being ingested by the ciliates. In suspensions of B. prodigiosus, the division rate of G. ficaria was approximately the same from pH 4.5 to 8.6, while in suspensions of three other species of bacteria the ciliates showed a typical bimaximal growth-pH curve with high points at pH 5.0 to 5.2 and at 7.6.

184. Growth of Colpidium in relation to certain incomplete proteins and amino acids. R. P. Hall and A. M. Elliott, New York University.

Media containing gliadin, zein, or gelatin, respectively, were found to be inadequate for continued growth of Colpidium (C. campylum and C. striatum) in bacteria-free cultures. However, addition of yeast extract in low concentrations (0.00005 per cent, approximately) made successive transfers possible.

Attempts to supply amino acids missing in the incomplete proteins were not successful, although in a number of cases addition of an amino acid resulted in some acceleration of growth. A very striking effect was obtained when an amino acid (e.g., lysine) was added to one of the protein media containing yeast extract as above; growth was distinctly increased, and in some cases even tripled. A similar effect was obtained with asparagin. Thus, a single amino acid or asparagin produced, under the conditions given, a decided acceleration of growth when added to a medium (e.g., gelatin-yeast) which will support slow growth of the ciliates in successive transfers. In the absence of yeast extract (or liver extract) addition of the amino acid produced a comparatively slight effect, or in some cases no acceleration at all. Results seem to be in accord with Emery's ('28) findings that single amino acids are removed from solution by ciliates, but at present no attempt is made to explain the effect of yeast extract. The factor of direct food supply can be eliminated, since little or no growth occurred in control media containing yeast extract (or liver extract) alone.

185. Characterization of species of Colpidium, with special reference to C. campylum and C. striatum. Alfred M. Elliott, State Teachers College, Bemidji, Minnesota. (Introduced by R. P. Hall.)

Colpidium campylum and C. striatum have been compared with descriptions of the well-defined species, C. colpoda, C. pannonicum and C. echini. It is concluded that all five are valid species. A detailed comparison of C. campylum and C. striatum has disclosed a number of morphological differences involving the cytostome, undulating membrane, macronucleus, contractile vacuole, body shape and ciliation. Certain physiological differences, including sugar fermentations and accelerative effects of carbohydrates on growth, are being reported in detail elsewhere.

The writer has found that Glaucoma piriformis (strain supplied by Hetherington and identification corroborated by Lwoff) is morphologically distinct from both Colpidium striatum and C. campylum. These differences involve body shape, cytostome, undulating membrane, contractile vacuole and other features. Swimming movements of G. piriformis are different from those of either species of Colpidium. In addition, Johnson (MSS) has found that Glaucoma ficaria and G. piriformis differ from Colpidium in sugar fermentations and in relative growth in media containing certain proteins and protein derivatives. These differences seem adequate for the separation of Glaucoma and Colpidium.

186. Population fluctuations in cultures of Paramecium. Edgar P. Jones, University of Akron and University of Pittsburgh.

A previous publication (University of Pittsburgh Bull., 29 (3): 141) recorded the fluctuations in concentrations of P. multimicronucleatum as observed in mass hay-flour cultures at intervals of 2 days. Destruction of individuals was believed to be by bursting.

The present investigation, employing the same technique of enumeration, secures data at more frequent intervals. Three cultures were studied. Each contained several hundred cubic centimeters of culture fluid. Consecutive enumerations of paramecia per cubic centimeter (by averaging three separate counts) at 4-hour intervals for 3 days were:

Culture F-2. 716, none, *388*, 454, 472, 484, 528, *674*, 578, 418, *338*, 556, 590, *668*, 580, none, *700*. (Maximum and minimum concentrations are in italic.)

Culture H-5. 366, 362, 332, 392, 340, 340, 380, 470, 362, none, 334, 472, 290, 524, 486, 472, 420, 506, 538.

Culture H-6. 732, 704, 682, 812, 704, 480, 704, 752, 788, none, 492, 762, 704, 742, 846, 1052, 772, 852, 658.

Graphic analysis of the above data clearly shows fluctuation of such an order that the total number of paramecia destroyed in the 3 days would approximate or exceed the maximum population recorded for that period. Fluctuations did not usually exceed 24 hours in length, and they took place continuously.

It is recognized that such rapid elimination, if characteristic, could explain the adjustment of Paramecium populations to unfavorable environmental circumstances.

MORPHOLOGY AND MISCELLANEOUS

Read

187A. Minimum length of life of the parasitic stage of Strongyloides ratti, as determined by single larva infections. George L. Graham, Rockefeller Institute for Medical Research. (Lantern; 12 min.)

When rats were exposed to only a single homogonic S. ratti larva each, infections occurred in about 35 per cent of the animals as indicated by the appearance of progeny in fecal cultures made from 5 to 11 days later. Coincident with the passage of this pure-line strain serially through ten parasitic generations by means of this simple technique, data were gathered relative to the length of reproductive life. The end of this may, or may not, be equivalent to the termination of the life of the parasite.

Variation in the duration of patency was observed. In several of the infections offspring were produced for only a single day. On the other hand, many of the solitary parasitic females were fertile for several months; one was still fecund when fecal examinations were discontinued 200 days after the host animal had been exposed to a single infective larva. However, the bulk of the parasites reached the negative phase or showed a marked decrease in the number of progeny in culture, in from 2 to 4 months.

Infctions of this type afford a unique method for longevity studies on single female parasites, for such simple infections, maintained in rats free from reinfection (hyperinfection does not appear to occur in this species), are not subjected to the complexity of biological factors operative where mass infections are established, i.e., the problem is reduced to its simplest terms.

187. Studies on the embryology and anatomy of the reproductive system of Iowa hawks. Allan J. Stanley and Emil Witschi, University of Iowa. (Introduced by P. L. Risley.) (Lantern; 10 min.)

Anatomical study of seven species of middle-western hawks shows occurrence of bilateral ovaries in all species examined except one. In Buteo platypterus platypterus (three specimens) only the left ovary is present. In Buteo borealis borealis (five specimens) bilateral ovaries are present, the right one appearing

as small scattered islets. In Buteo lineatus lineatus (four specimens) the right ovary is also present in reduced size and irregular shape. In Falco sparverius sparverius (six specimens) the right ovary occurs in reduced size but quite regular shape. A vestigial right oviduct has been noted occasionally in this species. In Accipiter cooperi (six specimens) bilateral ovaries are present. The only specimen of Accipiter velox velox examined shows complete bilateral ovaries. This condition is herewith reported for the first time in this species. In Circus hudsonius (twelve specimens) complete and probably functional ovaries are present. Although right ovaries occur in most of these hawks, no case of a functional right oviduct has been found.

Embryological study of four species shows that the rate of development is slower in the hawk embryo than in the chick. A 96-hour hawk embryo corresponds in general to a 48-hour chick. This time ratio holds approximately throughout incubation. Field study of Circus hudsonius shows that sexually dimorphic characters appear at the age of 8 to 10 weeks. At this time the male eye begins to turn blue-gray, while that of the female remains brown. From this time, the male remains smaller in weight and body measurements.

188. Abnormalities in flatfishes, Heterosomata. E. W. Gudger, American Museum of Natural History. (Opaque projection; 10 min.)

The laterally compressed flatfishes lie on one side which is white and eyeless, but have the upper side colored and two-eyed. Such fishes are abnormal fishes but normal flatfishes. If a flatfish, which normally lies on its blind and white left side and points to the right, lies on its right blind white side and points to the left it is called reversed. In the Journal of Morphology for September, 1935, I have tabulated under the name of each fish all published records and have discussed them to show in what fishes reversal is most common. No cause can be assigned.

If a flatfish has white spots on the upper side or dark ones on the lower, it is said to be piebald. If it is white above as well as below it is an albino and is ambicolorate. Ambicoloration, however, commonly has to do with color on the lower side. If this extends up to and even slightly onto the head, there will be neither eye nor head abnormalities. Such a condition is called simple or partial ambicoloration.

If the lower side including the greater part or all of the head is dark, such a fish is called totally or almost totally ambicolorate. Such a flatfish will have the anterior end of the dorsal fin hooked, and the rotating eye either on the dorsal crest or part way to the normal position. Four or five stages of these combined abnormalities have been found corresponding to the stages of rotation of the eye.

189. A whale shark off Long Island, the most northerly record. E. W. Gudger, American Museum of Natural History. (Opaque projection; 5 min.)

On August 9, 1935, an adult male Rhineodon typus was found in a pound net off Fire Island Light, L. I. It was brought into Islip where, after 23 years pursuit and study I for the first time saw the whale shark in the flesh. Its measurements were: total length, 31.5 feet; width of mouth straight across,

3 feet, 8 inches; width of head (flattened down) over curve between eyes, 5 feet, at first gill-slit, 6 feet, 5 inches; pectoral fin, 5 feet long; pelvic, 3 feet, 9 inches; first dorsal, 4 feet on base, 2 feet, 5 inches high; caudal along curve of upper lobe, 7 feet, 3 inches, of lower lobe, 4 feet, spread, 9 feet.

Mr. Thomas Rowland, taxidermist, of New York got the skin of this giant for mounting, and the American Museum got the skull, gill-arches, piece of oesophagus with tubercles, heart, eye, and claspers. The internal organs were too large to handle. The liver was 9 feet long, the spiral-valved intestine even longer.

This is the most northerly recorded occurrence. It has been found at Cape Inubo, Japan, lat. 35° 39′ N. In the Atlantic, one came ashore in 1934 at Southport, N. C., lat. 34° N. Fire Island is in lat. 40° 38′ N.—450 miles north of Southport and 335 north of Cape Inubo. The fish undoubtedly came north in the Gulf Stream.

A description of the fish and an account of its capture will shortly appear in Natural History.

MORPHOLOGY AND PARASITOLOGY

By title

190. SPHERULITES AS SPECIFIC CHARACTERS. E. A. Andrews, Johns Hopkins University.

In the three marine snails, Nerita pelloronta, versicola and tessellata, spherulites of calcium carbonate coming from the liver in the females are stored up in a special sac.

Many thousands of spherulites were collected from each of ten females, of each species, and when these spherulites were examined, it was seen that they differed not only from individual to individual but from species to species. The differences between individuals of a species were only in size, while the differences between species were not only in size but in roughness of surface of the spherulites and character of their cores.

There was also the added specific difference, that one of the three species showed the presence of great numbers of aggregations of precipitated granules of small size and no evident spherulitic structure.

Since the calcium carbonate in all these cases seems the same, the differences between species must base upon differences in the conditions of crystallization in each species. Apparently then, the specific character of each of these snails is expressed not only in the secretions of the outer surface in which crystallizations unite as continuous shell; but in secretions of the liver in which crystallizations produce spherulites that are not united.

191. SNAILS WITH GENERIC DIFFERENCES IN SECONDARY SEX ORGANS. E. A. Andrews, Johns Hopkins University.

Snails in the family Neritidae are known to bear upon the head of the male a large fleshy organ assumed to function in transfer of spermatophores.

In some species of the genus Nerita this organ is simple and directed forward, just to the left of the right eye. In some species of the genera Neritina and

Theodoxus this organ is forked and bent to the right under the right eye. We have verified part of the account of Bouvier (1887) of the remarkable form of this organ in Theodoxus cariosus from Hawaii.

Hitherto, no secondary sex organ has been noted on the females in the Neritidae, but we find in some species of both Neritina and Theodoxus, there is, to the right of the right eye, a small fleshy flap not present in males and absent from females of several species of Nerita. However, it is present in the remarkable fresh-water form from Jamaica described as Nerita alticola; but this species has some resemblances to Theodoxus.

This organ of the female may have some function in spermatophore transfer. Thus it may be that the genus Nerita is distinguished from Neritina and Theodoxus by having less complexity in the secondary sex organs, and that in this respect Nerita is less advanced than the other two genera.

192. Spermatophores as generic characters. E. A. Andrews, Johns Hopkins University.

Snails of the genus Nerita differ from snails of the genus Neritina in characters of shell, operculum and radula; all of which are products of secretion. We found also that they differ in nature of the objects stored up to be applied to the secreted capsules in which the eggs are laid. In addition, we now note that still other secreted products, namely, the large spermatophores, differ in these genera. In many Neritas the spermatophores are well known to be cylindrical bodies drawn out at one end as a long filament, and showing in the body a spiral structure that has been interpreted as annulation. Now in some Neritinas we find the spermatophores to be looped-shaped bodies, with no marked spiral structure. Also in some species the body has two filaments one of which bears a row of spicules that are tri-radiate. These are organic secretions formed one each in cells of a small gland not known in Nerita. Subsequently these spicules are assembled along one terminal filament, where they presumably play some part in fixing the spermatophore within the female.

Thus in some species, at least, observation of the spermatophores found stored within the female enables one to determine the snail as Nerita or as Neritina.

193. Regeneration of the anal fin of cyprinodont fishes. Leonard Grumbach, Cornell University. (Introduced by Myron Gordon.)

Regeneration of the anal fin of Platypoecilus maculatus, Xiphophorus hellerii, and hybrids of the two was studied at various stages in development. In these fish the anal fin of the males is transformed into an intromittent organ at the time of sexual differentiation; there is no change in form in the fin of the female.

Complete regeneration occurs in females irrespective of the age or stage of removal. The regenerated fin is about the same size or a little larger than the normal, although there are usually fewer segments in the rays of regenerated fins. The actinotrichia are larger and more numerous, and the lepidotrichia thinner in the regenerate than in the normal.

Complete regeneration of indifferent and young male fins takes place; the regenerates then develop into a gonopodium as normal males' would. The

regenerate is fairly typical although the segments are not so delicately and completely formed as in the normal. The more mature the animal was at the time of operation the less normal and more deformed the regenerated gonopodium. Three gonopodia failed to regenerate at all, and these were of old matured males.

194. Observations on the musculature of the red-spotted newt. H. D. Porter and H. H. Collins, Washington and Jefferson College and University of Pittsburgh.

In general, the muscles, especially of the limbs are much more clearly differentiated than in Necturus. It is suggested that this may be correlated with the fact that Necturus is a permanently aquatic form, while the red-spotted newt (Triturus viridescens viridescens) passes through a postmetamorphic terrestrial period of probably 2 to 3 years. In regenerated limbs the musculature of the normal limb is not perfectly reproduced. There is a tendency for the flexor and extensor muscles to become fused. Restoration of the normal musculature is most nearly perfect, when amputation is at the level of the wrist, but the tendency to fusion becomes increasingly evident as the level of amputation approaches the base of the limb.

195. Transplanted larval hearts in the adult red-spotted newt. W. H. Wright and H. H. Collins, University of Pittsburgh.

Entire larvae and larval fragments including the heart have been successfully implanted upon the body surface of the adult animal. In ten cases the larval hearts continued to beat for more than 100 days, the maximum being 165 days. In each of these cases, the record was terminated by the death of the host. In only two of a total of twenty-seven records did the larval heart cease to pulsate prior to the death of the host. A great fluctuation in the rate of the larval heart beat in grafts was observed after they were healed in place, as shown in two extremes, from 6 to 130 times per minute. Frequently, the rate fluctuated widely in a single graft, as in one case, for example, where the rates 50, 130, 90, 110 and 60 times per minute were recorded within a period of 30 days. The pulsations of the implanted larval heart almost never coincided with the cardiac rhythm of the host.

The rate of heart beat in larval grafts, in general, becomes less rapid approaching the normal rate of the adult heart but becoming synchronous with it only in a small percentage of cases. Two circulations were not infrequently to be seen in a single graft, a relatively slow one in the larval vessels, and a more rapid flow in the invading vessels from the host. This condition was of relatively short duration, ceasing apparently when the two systems of blood vessels became inter-connected.

196. Growth and differentiation of larval grafts upon the adult red-spotted newt. W. H. Wright and H. H. Collins, University of Pittsburgh.

Larval grafts in general became highly vascularized soon after implantation. They may assume a blood red appearance, and undergo dedifferentiation in varying degrees. Vascularization later subsides and the grafts may become more or less transparent amorphous masses. This is followed by growth, pigmentation and partial redifferentiation. Legs of larvae from 22 to 32 mm. in length, and nearing the time of metamorphosis grafted upon the bodies of adults, became heavily vascularized, enlarged and then dedifferentiated assuming a more or less spherical form. Later the leg was redifferentiated, but was more like an adult leg in proportions. A larval head retained the mouth opening and gulping reflexes, as well as power to move from side to side until the death of the host, 6 months after operation. Regeneration of amputated limbs of the adult was totally inhibited by implantation of larval fragments on their cut ends. Entire larvae implanted within eye sockets of the host, and in subcutaneous pockets were studied for varying periods up to 3 months. The larval bodies became reduced to amorphous masses with mouth openings, nares and eyes persisting longer than other external features. Abortive redifferentiation followed being best seen in the outgrowth of pectoral limbs.

In general, the potentialities of a graft are not lost in the process of dedifferentiation, a tail graft, for example, growing out a new tail from its amorphous mass, but there is a suggestion of host influence in form regulation.

197. Further studies of the 'ovate bodies' and structure of the hair of the fossil ground sloth (Nothrotherium shastense). Leon Augustus Hausman, New Jersey College for Women, Rutgers University.

A study made in 1929 (Am. J. Sci., vol. 18, p. 331, October, 1929) of the structure of the hair of the Yale specimen of the fossil ground sloth (Nothrotherium shastense), revealed the presence of numerous problematical appearances not a portion of the hair shafts themselves, and then termed 'ovate bodies.' They brought to mind the symbiotic algae resident on the hairs of the modern sloths, Choloepus didactylus and Bradypus tridactylus. The majority of the ovate bodies contained a central mass suggestive of the plasmolyzed contents of a cell.

Recent studies of a fresh series of hair samples from the Yale specimen brought to light, besides numerous single ovate bodies, an individual divided midway in its length, as though in the process of binary fission. A darker central mass within the cell was similarly constricted. From this, and previous findings since the original study was made in 1929, and from the unpublished investigations of Mrs. Elizabeth Parsons Wheeler, the hypothesis is now advanced that the ovate bodies of the Nothrotherium hair shafts are algal cells, similar to the Pleurococcus choloepi and P. bradypi of Kühn resident on the hairs of modern sloths. The ovate bodies of the Nothrotherium hairs lay always upon the outer surfaces of the cuticular scales and were not present where the scales were much worn or absent. If the ovate bodies are to be regarded as veritable algal cells, then the sparsity of individuals in stages of fission is problematical.

198. Measurements of the skull and of some of the long bones of the skunk (Mephitis mesomelas avia). Homer B. Latimer, University of Kansas.

The skull, mandible, atlas and six long bones from 143 skeletons were weighed. Eleven linear dimensions of the skull, the lengths of the six long bones, the scapula and the os coxa were measured in 208 skeletons.

All of the weights and all of the linear dimensions except the interorbital diameter of the skull are significantly greater in the male.

The skull weight in both sexes is the least variable of the weights except the weight of the female mandible. The skull length is more constant than the other dimensions of the skull or the lengths of the long bones.

The skull weight is a good criterion of the weights of all of the other bones studied, as shown by the significant coefficients of correlation. The correlations for the males are slightly greater than for the females. The correlations of the linear dimensions with skull length are also positive and all significant except the diameters of the foramen magnum and the interorbital diameters in both sexes.

Both bones of each pair were weighed and measured separately and the averages used in the preceding data. The ulna, femur and scapula were longer on the left side in both sexes and the humerus, radius, tibia, fibula and os coxa were longer on the right side. The weights do not show as definite an asymmetry. The ulna and femur were heavier on the right side in both sexes and the scapula on the left side.

199. The American species of the genus Stenostomum. John W. Nuttycombe and Aubrey J. Waters, University of Georgia.

The status of many of the American species of the genus Stenostomum has been questionable because of inadequate descriptions and illustrations and scattered literature. We have eliminated invalid species, redescribed many species, made careful illustrations for all species we have been able to obtain and have devised an effective key for identification. This paper also includes data on habits, collection and culture of the various species.

200. Observations on the prenatal transmission of Trichinella spiralis. Fred J. Holl and Nicholas I. Valvo, University of Buffalo.

The possible transmission of Trichinella spiralis from pregnant rats to offspring was studied. The females were fed infected meat or larvae which had been liberated by artificial digestion. The liberated larvae were introduced into the stomach by means of a stomach tube. One hundred and two young, from thirty litters were studied. The muscles of the young rats were first examined microscopically and later digested and examined for larvae. None of the young examined showed larvae of T. spiralis. Since the larvae of T. spiralis usually select muscles with a high glycogen content, it is suggested that the failure of larvae to pass through the placenta, as many other helminths do, may be due to a difference in the glycogen content of the maternal and foetal layers of the placenta.

ECOLOGY

By title

201. THE DIURNAL, VERTICAL DISTRIBUTION OF A CHLOROPHYLL-BEARING ORGANISM BELONGING TO THE GENUS PHACUS. R. P. Cowles and Charles Brambel, Johns Hopkins University.

The distribution of this organism in a bog pond situated near the Marine Biological Laboratory at Woods Hole, Massachusetts, and known locally as 'Cedar Pond,' was studied at various depths and at different times of the night and day, during the month of August, 1935.

At 9 A.M., on bright days, the largest numbers were found between ½ and 1 meter from the surface: e.g., surface 50, 0.5 M. 300, 1 M. 3400, 1.5 M. 100, 2 M. 200, 2.5 M. 100, 3 M. 100, 3.5 M. (bottom) 100. A number of other counts on different days and at various locations in the pond gave similar results. Furthermore, on bright days, this maximum count, at from 0.5 M. to 1 M., seems to persist till 1 P.M. when downward migration begins to reduce the numbers at the depth mentioned. By 5 P.M. the largest counts are to be found much lower down. This condition persists till about 1 A.M., judging from observations made at intervals of 4 hours for 24 hours at two different times during the month, and then upward migration begins again, so that by early morning the largest counts are found again at from ½ to 1 meter from the surface.

A measurement of the light intensity, using a Weston photometer, was made at the surface of the water and the values obtained show some correlation between light intensity and the diurnal vertical migration. Other factors, however, are undoubtedly involved.

202. SOME PHYSICAL AND CHEMICAL CONDITIONS FOUND IN A BOG POND. Charles E. Brambel and R. P. Cowles, Johns Hopkins University.

During a study of the distribution of a chlorophyll-bearing organism (Phacus) in a bog pond near the Marine Biological Laboratory, at Woods Hole, Massachusetts, certain chemical and physical data were obtained which are discussed below.

A distinct 'oxygen pulse,' i.e., an increase in dissolved oxygen, occurs on bright mornings at from ½ to 1 meter depth where the maximum numbers of Phacus are found.

The temperature of the water decreases rapidly from the surface downward and a temperature of 9°C. in August has been recorded at the bottom. This indicates a subterranean source of water for the deeper part of the pond. No well-defined thermocline could be made out.

From the surface to 1 meter the pH does not reach 5.0 and this means the absence of carbonates. Such water evidently makes its way into the upper layers of the bog pond from the acid sphagnum bog which surrounds it. Below 1 meter, however, the water becomes more alkaline with a pH at the bottom of almost 7.0.

A sudden increase in total CO_2 content occurs at the depth mentioned (e.g., from about 4 to 50 p.p.m.). This means an increase in carbonate and it is correlated with a distinct rise in pH. This is one of the most striking phemonena of the bog pond. No correlation could be made out between the distribution of Phacus and the total CO_2 values.

203. On the spiders of Barro Colorado Island, Panama Canal Zone.. A. M. Chickering, Albion College.

Three extensive collections of spiders have been made on this island, two of them (1928, 1934) by the author of this report. In the second collection made from this place, the author has recognized about 400 species of these animals which belong to 34 different families. Many new local records have been established and more than 100 new species found. Intensive methods of collecting reveal an astonishing number of species in this small area. Descriptions of the species new to science are being prepared for publication. Comparisons will be made with the lists of spiders reported by Petrunkevitch ('25) from the Pacific slope of Panama, and Banks ('29) from the Atlantic slope with the intention of more accurately determining the affinities of the Aranead fauna of the region.

204. An experimental study of predatory action in flour beetle populations. Royal N. Chapman and Bertha Hanaoka, University of Hawaii.

Experiments have shown that there is no significant difference in the time required for the development of Tribolium confusum larvae fed entirely upon eggs of their own species, or upon whole wheat flour, or various populations of eggs in whole wheat flour. This makes it evident that a larval population derives no direct benefit from egg eating when in a medium of whole wheat flour. The number of eggs eaten each day increases with the age of the larvae except for interruptions at the periods of moulting. When larvae or adult beetles are placed in a series of cultures containing a geometric series of egg populations the egg eating increases as the egg populations increase. This confirms previous results showing that the action of Tribolium larvae in preying upon the eggs of their own species in flour cultures is an important factor in determining the egg populations that may be found at any time. Succeeding populations of larvae will be reduced because of the lower egg populations from which they may hatch.

205. Studies in nocturnal ecology. VI. Further investigation of activity of Passalus cornutus and description of new recording apparatus. Orlando Park, Northwestern University.

Using recording apparatus described previously, the activity of the beetle, Passalus cornutus, was reinvestigated. Individual beetles were marked differentially and their activity recorded for periods of 24 consecutive hours under constant air temperature and relative humidity but varying conditions of illumination as follows: 1) constant darkness, 2) constant light (29–30 foot-candles), and 3) reversed illumination, e.g., dark during the day and illuminated at night. The animals in all three series of trials behaved similarly, 50 per cent of their total activity being diurnal and 50 per cent nocturnal, which substantiated the previous view of the author, that the species falls in the third category of activity, viz., the arhythmic type.

A new recording apparatus is described. The apparatus utilizes the principle of audio frequency and by means of four stages of amplification and a special microphone the movements and stridulation of small insects can be accurately recorded by a relay pen on a 24-hour drum.

206. The physical limitations of Centrarchid nest construction. C. M. Breder, Jr., New York Aquarium.

The nature of the pond bottom mechanically limits the depth of centrarchid nests. In a pond with only soft mud, unsuccessful nests have been found as deep as 2 feet made by 5-inch Eupomotis and Lepomis. On clean concrete nest digging movements are as persistent but with no visible effect; Eupomotis, Lepomis, Ambloplites, Aplites.

The nature of the bottom and rate of water flow determine the shape of the nest; a homogeneous bottom in still water causing the production of perfectly circular nests, and a flow leading to oval ones with the long axis parallel to it, Eupomotis, Lepomis, Aplites. The ratio of long to short axis is proportional to the flow up to the limits in which a fish can hold its position. Inequalities in the substratum account for asymmetrical and irregular nest outlines. Nest building is closely associated with sunshine. The passage of a cloud will usually cause a suspension of nesting activity and a retreat to deeper water. The fish may return after a time, even if the sun does not show again, but the disappearance of the cloud brings them back immediately.

All of the visible variations in centrarchid nests are thus apparently referable to differential qualities in the environment, to fixed fanning and circling movements, which vary from species to species, chiefly in vigor and extent of activity; e.g., Eupomotis, Lepomis, Helioperca, Aplites, Micropterus, Ambloplites, Enneacanthus and Mesogonistius.

207. Selection of nesting sites with intraspecific and extraspecific interactions in nesting Centrarchidae. C. M. Breder, Jr., New York Aquarium.

Selection of nesting sites by Centrarchids, Eupomotis, Lepomis, Aplites, is governed by two antagonistic influences: 1) the centrifugal effect between breeding males tending to scatter the nests, 2) the usual limitations of suitable pond bottoms tending to condense them in colonies. Where there is more suitable bottom than the demand calls for they may be widely scattered, or under reverse conditions be in peripheral contact. Depth of water is somewhat correlated to size of fish and consequently to size of nest. This operates to segregate the fishes along contour lines, the smallest being closest to shore and in the most shallow water.

The first fishes usually select sites close to some sheltering object, such as a rock, leaving the late comers to the less protected sites. All of the factors contributing to the exact site selected for operations are not clear at this time but they include, at least, depth of water, relative protection, the presence of some slight depression, slightness of flow and amount of light. More nests are to be found in the sunny portions of a pond. This is independent of water temperature. Where more than one species nest on one ground, the smaller usually appropriate nests of the larger. Thus, Eupomotis may use those of Lepomis and both use those of the earlier spawning Aplites. Probably there are less evident homospecific exchanges but these have not been detected.

208. A TECHNIQUE FOR THE QUANTITATIVE MEASURE OF TROPISMS AND SOCIAL BEHAVIOR IN ACTIVE ANIMALS, WITH AN ILLUSTRATION. C. M. Breder, Jr., and R. F. Nigrelli, New York Aquarium and New York University.

It has been shown, Schuett ('32), that the total travel of Carassius, in an aquarium, in a specified time varied with the degree of crowding, independent of other factors. Observations were made by reference to rulings on the tank walls in three dimensions. Large numbers of fishes increased speed of travel, as did low numbers, a minimum speed being reached with an intermediate number.

This was confirmed and it developed that another effect could be deduced from the same data. The positions in space, at regular time intervals, may be plotted as frequency curves for each of the three dimensions. Solitary fish, protected from outside stimulae, in addition to travelling more rapidly than when with others, kept more to the sides of the aquarium producing curves convex downward. With other fish present curves convex upward were produced; that is, the fish spent more time in mid-water. This may be interpreted as an expression of an aggregating reaction, unsatisfied in the first and satisfied in the second. Outside influences, such as light from one side, produced appropriately asymmetrical curves. This technique should find use in the study of tropisms in active organisms. Not only does it supply a simple means of studying tropistic and social behavior of any degree of complexity in such organisms, but also gives a numerical measure of the effect of each stimulus. The geometrical modes and arithmetical averages of positions in three planes are readily calculated.

209. POST-ASYMPTOTIC STUDIES IN POPULATIONS OF LEBISTES. C. M. Breder, Jr., and C. W. Coates, New York Aquarium.

Both limbs of the logistic population curve have been shown for standing aquaria populations of Lebistes (Breder and Coates, '32). Identical asymptotic values of nine fishes were reached in about 26 weeks by both the initially over- and under-populated aquaria. Three aquaria of 5.5 liters each were used and have now characteristics omitting the first year which includes the preasymptotic values passed their fourth year (August 15, 1931, to date). They show the following and the artificial initial populations.

The numbers of fishes increased to an average of 14.4+. The sex ratios remained practically 1 male to 2 females, actually 1 male to 1.9+ females. These and other population characteristics showed an annual cyclic variation as follows. The summer 6 months gave averages of number of fishes 15.2+; volume of fishes 2.3– cc.; sex ratio 1 to 1.5–; number of adults to young present 4.1+. The alternating winter 6 months gave, respectively, 13.6–; 2.6+; 1 to 2.3+ and 7.8+.

These differences cannot be due to temperature to any large extent, since the average summer temperature was 26.89° and the winter 26.35°. As all of the conditions were kept as uniform as possible the differences between summer and winter values would seem to clearly indicate that the hours of daylight, which were not controlled, are involved in all population variables noted.

A list of abstracts of papers presented by members or introduced by members of this Society at the meetings of Section F of the American Association for Advancement of Science at St. Louis. These are arranged in the alphabetical order of the authors' names.

210. Studies on living cells. W. J. Baumgartner, University of Kansas. (Lantern; 10 min.)

A study of the living cells of the testes of the grasshoppers shows that the structures which have been described by the use of fixed material can all be seen in the living cells. The various cells can be recognized in practically all the major stages which have been named in fixed specimens. Hundreds of cells have been followed through mitosis. The time necessary for actual division is not readily determined, as there is a rather long period of relative inactivity just before the chromosomes go into metaphase. Pseudopodia appear upon the surface of all cells when the nutrient fluid becomes hypertonic. If the solution is only very slightly hypertonic the pseudopodia will appear only at the polar regions during middle or late anaphase. This last fact would indicate that the surface membrane is less resistent at the poles during anaphase, or that there is increased pressure at that point during that period, likely caused by the flowing of the protoplasm.

211. Effects of centrifugal force on the structure and development of the eggs of Fucus serratus. H. W. Beams, State University of Iowa.

Strong centrifugal force causes a marked redistribution of cellular materials in eggs of Fucus serratus before cleavage whether fertilized or unfertilized. The materials stratify in the order of their decreasing specific gravity as follows: 1) a layer of clear, but granular cytoplasm occupying about two-thirds the volume of the cell; 2) a layer of chloroplasts which frequently contains numerous small granules which stain like mitochondria; 3) the nucleus, or in the case of dividing cells, the mitotic figure is observed to take up a position just centripetal to the chloroplasts, and 4) a layer of gray material which no doubt contains considerable amount of fat.

The nucleus migrates back to the center of the cell, its normal position, within 6 to 10 hours after centrifuging an egg which has just been fertilized. Subsequent division of the egg is normal and without regard to the other material which remain stratified. Some eggs are found where the plane of division has separated all the chloroplasts and the gray lighter layer into one of the daughter cells. Eggs have been observed to fuse and give rise to giant eggs with more than one nucleus. Such eggs often form supernumerary rhyzoids as described by Whitaker, and frequently give rise to atypical sporelings.

The method of Loeb as used by Overton was found quite successful in inducing parthenogenetic development in Fucus. The chromosomes of such plants have not, as yet, been studied.

212. A NEW ADAPTATION OF THE ULTRACENTRIFUGE FOR MICROSCOPIC OBSERVATION. H. W. Beams and R. L. King, State University of Iowa.

213. ENZYMES IN ONTOGENESIS (ORTHOPTERA). I. TYROSINASE. J. H. Bodine and E. J. Boell, State University of Iowa.

A quantitative study has been made of the tyrosinase activity of the egg of the grasshopper, Melanoplus differentialis, throughout its complete development. Enzyme concentration has been expressed in terms of the oxygen uptake per 100 minute intervals in the oxidation of a given amount of substrate by the enzyme, extracted in phosphate buffer pH 8.0, from twenty eggs.

Tyrosinase concentration increases during the first 20 days of development at 25°C. when maximum activity is reached. This level of enzyme activity is maintained practically constant throughout the remainder of the developmental period.

By far the larger part of the tyrosinase content of the whole egg is contained in the yolk, serosa cells and fluids surrounding the embryo. The amount of enzyme in the embryo itself is slight until after blastokinesis when yolk and serosa cells have been engulfed by the embryo. At that time a transfer of enzyme from yolk to the embryo must occur.

214. ENZYMES IN ONTOGENESIS (ORTHOPTERA). II. THE INDOPHENOL OXIDASE. J. H. Bodine and E. J. Boell, State University of Iowa. (Lantern; 8 min.)

A comparison has been made between the oxygen uptake and the indophenol oxidase activity of eggs of the grasshopper, Melanoplus differentialis, throughout development.

During the first 3 weeks of development at 25°C. the oxygen consumption and the indophenol oxidase activity of the egg increase in an approximately parallel fashion, a maximum for each being reached on the twentieth day. Following this, a period of embryonic block (diapause) normally ensues. The oxygen uptake of the egg is reduced to a value approximately one-fourth of that found on the twentieth day. Oxidase concentration throughout diapause, however, remains unchanged at the 20-day maximum. After diapause, development which leads to hatching 18 days later is again resumed. The increases in oxygen consumption and indophenol oxidase activity during this period are, as in diapause, again practically parallel.

Respiration of the eggs immediately before and after diapause is approximately of the same magnitude and is greatly affected by cyanide. During diapause the respiration of the egg is cyanide insensitive. With respect to their ability to oxidize p-phenylenediamine eggs in the three developmental states are all alike. Hence the indophenol oxidase cannot be the limiting factor in the restriction of the cyanide sensitive respiration during diapause.

215. STRUCTURE AND RESPIRATORY ACTIVITY OF DEVELOPING EGG (ORTHOPTERA). J. H. Bodine and E. J. Boell, State University of Iowa.

The eggs of the grasshopper, Melanoplus differentialis, when crushed and suspended in balanced salt solution buffered to pH 7.5 show a considerable oxygen uptake which, after an initially rapid rate is maintained at a constant level for several hours.

In actively developing eggs the equilibrium value of oxygen uptake is approximately 25 per cent of that of the intact egg. However, for eggs in a state of developmental block (diapause) the rates of oxygen uptake of crushed and intact eggs are practically identical.

The respiration of the egg brei of both developing and blocked eggs is not affected by cyanide and carbon monoxide. Urethane, however, exerts a slight depressing action.

The respiratory rate of developing embryos, freed from egg yolk and extra embryonic membranes and whose cellular structure is intact, is much less than that of the intact whole egg. The oxygen uptake of such embryos may be inhibited by cyanide and carbon monoxide. During diapause the difference between the respiratory rates of whole intact eggs and isolated embryos is not as marked as during developmental stages. Carbon monoxide, moreover, has no effect on the respiration of embryos from diapause eggs.

216. Rate of dehydration by hypertonic solutions. J. H. Bodine and Vincent Thompson, State University of Iowa.

Rate of dehydration of eggs of Melanoplus differentialis is related to activity of embryos. Weight losses per unit time of eggs in ten normal Belar increase as the embryo becomes older. Embryos in diapause are most resistant to water loss. Temperature has a greater effect than can be due to ordinary physical forces. Oxygen consumption of embryos is related to water content, decreasing as the egg loses water.

217. Testicular heterotransplantation in rats and mice. Ludvig G. Browman, The University of Chicago. (Introduced by Carl R. Moore.) (15 min.)

Testicles of rats and mice were transferred, 1) to a different location in the same individual (autotransplant); 2) to individuals of the same species (homotransplant); and 3) to individuals of the other species (heterotransplant). Rat and mice hosts that received auto- or homotransplanted testicular substance yielded well-incorporated, functional grafts which revealed active spermatogenesis. Successful auto- and homografts in castrated males caused the seminal vesicles to have high secretory epithelium with secretion granules, thus indicating hormonal activity.

Heterografts recovered from rats and mice contained no tissue that revealed active spermatogenesis. Transplants of mouse testicles to rats resulted in grafts with well-stained testicular elements embedded in a necrotic non-vascular periphery, within the host capsule. Heterografts from either species contained spermatozoa in necrotic tubules 5 or more months following transplantation. Heterografts were hormonally inactive as revealed by the low secretory epithelium with absence of secretion granules in the seminal vesicles of castrate male hosts.

Various attempts to reduce host resistance to heterotransplanted testicles by means of adrenalectomy, splenectomy, reticulo-endothelial blockade, and x-ray treatments resulted in no marked increase or decrease in the host resistance.

218. Effects of exposure to low temperatures on developmental time of embryos of the grasshopper, Melanoplus differentialis (Orthoptera). Harold C. Burdick, State University of Iowa. (Introduced by J. H. Bodine.)

Experiments have been designed to study the effects of four temperatures below developmental zero (hatching) on the hatching time of the embryos. Embryos of different ages have been exposed to low temperatures for various periods of time. When not at low temperatures they have been kept at 28°C. Control groups have been kept at 28°C. from the time of laying. Eggs of M. diff. exhibit a developmental block, or diapause, and so consideration must be given both the period when visible morphological changes are occurring and the period of developmental block. Examination of the control groups indicates that there is a great deal of variation in the duration of the developmental block. This variation is not entirely random, and it appears that eggs laid by young females (eggs collected early in a season) have a longer diapause than eggs laid by older females (eggs collected late in a season). Experiments indicate that only with a very few combinations of temperature, exposure, and morphological stages is it possible to reduce the time from egg laying to hatching below that of controls kept at 28°C.

219. An anomalous abdominal vein in the bullfrog, Rana catesbeiana Shaw. Harold C. Burdick and Mary L. Moore, State University of Iowa. (Introduced by J. H. Bodine.)

A specimen of the bullfrog used in the general zoölogy laboratory was found to have an anomalous abdominal vein. Posteriorly the vein arose by the fusion of the two pelvic veins. It proceeded anteriorly to the level of the second line of segmentation in the rectus abdominis muscle, then turned abruptly to the left and followed the line of segmentation to the margin of the muscle where it penetrated musculature of the body wall. It joined the musculocutaneous branch of the subclavian vein and so emptied into the left precaval vein instead of joining the hepatic portal system.

220. Regeneration in frog skin after x-ray injury. John A. Cameron, University of Missouri. (Lantern; 10 min.)

Serial sections cut from 18 mm. squares of frog skin having at their centers 6 mm. squares which had been exposed to 1000 r were prepared at intervals of 1 week for 10 weeks following irradiation. During the 10-week period the burned epidermis lost three of its five layers by desquamation, showing definite injury in the two remaining basal layers. It was then restored to the five-layered condition, the injured cells of the basal layers having been replaced. The mitotic index as determined by counts of 10,000 irradiated and 10,000 control cells for each week ranged from 0.05 per cent to 0.2 per cent. In no case was the difference between the irradiate and control statistically significant. Lateral migration was not a factor, since there was no cut surface or free edge.

Uninjured cells first appeared in the epidermis just distal to the terminations of vertical connective tissue fiber bundles of the dermis. Such cells were later found in series or sequences radiating out from the vertical bundle terminations.

The number of spindle-shaped connective tissue cells on the vertical bundles was increased 50 per cent to 100 per cent in the irradiates. No recovery stages were observed in the epidermis so it was concluded that the replacement noted was principally due to the migration of mesodermal cells from the dermis into the epidermis.

221. Components of the Mitotic Spindle. E. Eleanor Carothers, State University of Iowa. (Lantern; 15 min.)

The evidence presented is believed to justify the following conclusions: 1) Chromosomal fibers (half-spindle fibers) are in reality pseudopodial-like processes. They are put forth by definite chromomeres, therefore, normally are fixed in position. 2) Due to mutation, using this term in a broad sense, some other chromomere may assume this function with a resultant change in position of the spindle processes which does not involve either inversion or translocation of chromosomal segments. 3) At anaphase the processes, beginning with the heavier basal parts, are reincorporated into the sister chromatids as they move toward the poles. 4) The interzonal fibers behave as one would expect under the existing conditions; namely, flexible, viscous protoplasmic rods are separating in such a manner that the final contact is end to end. As these ends separate the viscous protoplasm belonging to each is drawn out between them in varying degree depending on such factors as the rapidity of the movement and the density of the chromatids. The final separation of the 'fibers' near the middle is precise and each end is retracted into its own chromatid. 5) Both chromosomal fibers and interzonal fibers are integral parts of the chromosomes and return to them during anaphase without loss of chromatin or linear derangement of their constituents.

222. The Degree of development of the bull snake embryo at the time of egg laying. Edw. P. Churchill and J. A. Harris, University of South Dakota. (7 min.)

A female bull snake (Pituophia sayi) which had been in captivity for at least 1 month, during which time no male was present, laid several eggs on June 25th. Some were opened when laid and others kept in incubation in sand and opened on later days. Embryos of about 7 mm. in length were found in the eggs opened at the time of laying. Successively larger embryos were found in eggs opened in 3, 12 and 18 days. The one from the 18-day egg measured 20 mm.

A 7-mm. embryo from an egg opened when laid was sectioned and studied for comparison with chick embryos. The snake embryo corresponded in degree of development to the 4- or 5-day chick. Among other details, the brain had the five main divisions and fore gut and hind gut had lengthened until the mid gut had become a mere yolk stalk.

In summation, the investigation shows that the eggs of the bull snake are not laid for at least 1 month after fertilization, during which time they reach a relatively advanced stage of development and do not hatch for at least 18 days after being laid.

223. Some parasitic protozoa from the Lake Okoboji (Iowa) region. G. Robert Coatney, Peru State Teachers' College, Nebraska.

While working as an independent investigator at the Iowa Lakeside Laboratory, during the summer of 1935, seventy-eight vertebrates, belonging to twenty-four species, were examined for blood parasites. This included sixteen species of birds, four species of reptiles, two species of fish and two species of mammals. The blood parasites found belonged to five genera (Haemoproteus, Plasmodium, Leucocytozoon, Trypanosoma and Haemogregarina). With two exceptions these are all new host records and at least two are species new to science.

Besides the blood forms, a new coccidium was taken from Forster's tern, Sterna forsteri Nuttall. The morphology of the mature oocyst and the rate of development, outside the host, were carefully worked out. The parasite is being described as Eimeria meservei.

224. Effect of KCN upon Melanoplus differentialis eggs. Evelyn Cook, State University of Iowa. (Introduced by J. H. Bodine.)

This work concerns the effect of 0.02 per cent KCN solution upon prediapause eggs at 25°. Results tend to show that eggs under 21 days of age vary in their sensitivity toward cyanide, becoming more sensitive after approximately the tenth day at 25°. Whether this is true of all the eggs, or found only in some and not in others, is now being determined. Studies on older eggs show a relative effect of KCN depending upon the age of the eggs and the strength of the KCN solution. These experiments are now being repeated to see whether the first results will be substantiated.

225. A cytological study of striated muscle following fat extraction. Herbert L. Eastlick, Washington University. (Introduced by Florence M. Heys.) (Lantern; 15 min.)

The Kolatchev technique, widely used for fixing the Golgi apparatus, when applied to skeletal muscle stains the (Z) and (M) membranes and occasionally the borders of the (Q) disc. If one modifies the usual procedure by placing the muscle in ether, chloroform, benzene or other fat solvents for several hours and, after removal of the fat solvent, applies the Kolatchev technique, the bands still stain black with osmic acid. The above method does not exclude the possibility that perhaps the fat solvents had not penetrated the tissue due to their immiscibility with cell fluids. The muscle was therefore fixed in various reagents, 4 per cent formalin, 10 per cent alcohol, etc., then passed through graded alcohols. After thorough dehydration the tissue was placed in various fat solvents and extracted. Following the extraction, the fat solvent was removed by washing many times in anhydrous Dioxan, and the tissue was passed to water and then fixed with the Kolatchev method. The bands which reduced osmic acid under normal conditions were found to occur even after the above procedure. Moreover, it was discovered that boiling a dehydrated muscle in ether for 1 hour does not remove the material which reduces osmic acid. This seems to indicate that osmic acid stains substances in muscle which are not of a lipid or phospholipid nature since the above procedure, seemingly, should have ruptured the lipo-protein complex and allowed the extraction of the phospholipids. It is suggested, tentatively, that osmic acid oxidized proteins in muscle.

226. Some factors in the appearance of roentgen ray effects on the development of Melanoplus differentialis. Titus Carr Evans, State University of Iowa. (Lantern; 15 min.)

Eggs have been irradiated in practically all stages of development and several factors have been found to influence the character and time of appearance of the effects.

As the eggs change from the syncytium condition (1 to 2 days, 25°C.) to that containing a definite embryo (4 to 5 days) the effect of irradiation changes from total destruction to more frequent but localized injuries. The period during which the first parts of the embryo are being formed (4 to 6 days) is most susceptible to injury by the roentgen rays. Many eggs irradiated at this time contain embryos with extensive anomalies of structure when examined 20 days later. The extent of the injury is greater and the appearance of the effects are more rapid as the dosage is increased. As the embryo develops and becomes more differentiated it requires more irradiation to result in immediate injury. The embryo becomes extremely resistant about the twenty-first day and this is apparently associated with the decrease in developmental activity which occurs at this time. Appearance of roentgen ray injury is rapid if development is continuous, but if the embryos are developmentally inactive following the irradiation the appearance of the injury is delayed.

Experiments in which only parts of eggs (1 day old) were irradiated indicate that the nuclear region is most sensitive. The rates of oxygen consumption of eggs irradiated heavy dosages with only nuclear region exposed remained low, but when the nuclear region was protected with lead and the rest of the egg so treated the oxygen consumption rate was not retarded and (under certain conditions) was even accelerated.

227. Structural anomalies of grasshopper embryos resulting from Roentgen irradiation. Titus Carr Evans, State University of Iowa.

Irradiation of eggs while the embryos are in the first stage of formation results in the production of many structural anomalies. These abnormalities range in character from small and localized variations of structure to enormous outgrowths chiefly from the medial regions of the head. The latter type is most striking and the growth of the affected region continues long after the rest of the embryo has become inactive at the time of diapause. The outgrowths first appear as apparently unorganized protrusions, but older stages show definite attempts to form one or more new embryos.

228. The 'intracellular symbionts' of some Blattidae, their nature and behavior. Herschel T. Gier, Indiana University. (Introduced by Will Scott.) (Lantern; 10 min.)

The life cycles of several species of cockroaches have been studied with reference to the behavior of their 'intracellular symbionts.' These are always present in the fat body and ovaries. The bacillary 'symbionts' come in contact with the oocyte early in the growth period, multiply rapidly between the egg and its follicle, and aggregate in clumps at each pole of the egg late in the growth

period. The 'symbionts' pass into the cytoplasm of the egg as the vitelline membrane is being secreted. They remain at the poles until the embryonic rudiment is formed, when they migrate to the center of the yolk. Before the walls of the mid-gut are completely formed, the 'symbionts' pass dorsally out of the yolk, then posteriorly into the syncytial mass which is to become the fat body. The gonads form in this mass. Some of the 'symbionts' become enclosed with the germ cells by the ovarian connective tissue. The 'symbionts,' lying free between the germ cells and multiplying by transverse fission, work toward the tip of the ovariole as new oocytes develop.

These 'symbionts' blacken slightly with osmic acid, withstand prolonged action of ether-alcohol or Carnoy's fixative, stain green with acid fuchsin-methyl green combinations, do not give the Feulgin reaction, but stain by most bacteriological methods. Attempts to cultivate the 'symbionts' on numerous kinds of artificial media have been unsuccessful, yet their behavior and staining reactions indicate they are bacterial in nature.

229. TISSUE EXTRACTS AND HEAVY METAL SALTS AS ACCELERATORS OF METAMORPHOSIS OF ASCIDIAN LARVAE. Caswell Grave and Paul A. Nicoll, Washington University. (Lantern; 15 min.)

Working with the larva of Phallusia nigra and Polyandrocarpa tincta it was shown, at the Tortugas Laboratory, 1935, that metamorphosis is accelerated several hundred per cent by placing larvae in water extracts of adult and late embryonic, ascidian tissue.

Attempts to isolate the active fraction have so far yielded results that are limiting rather than decisive. Previous extraction with fat solvents does not lessen the activity of following water extracts. Protein-free filtrates show the same activity as original untreated solutions. Refluxing extracts for several hours, or evaporating them to dryness and dissolving the residue, or even heating the tissue itself at 140°C. for 24 hours likewise has no effect on the accelerating activity of the resulting solutions. Complete charring of the original tissue does, however, yield inactive extracts. Present results from dialysis experiments are inconclusive.

These results suggested the possibility of water soluble inorganic salts as the effective agent. Using mostly larvae of P. nigra solutions of available inorganic compounds were tested. Li, V, Mg, Mn, Ce, Co and K compounds were inactive, while Cu, Fe, Al, Ni, Zn and concentrated Ca salts accelerated metamorphosis. Zinc and nickel salts were but weakly active toward P. nigra and showed no accelerating effect on P. tincta larvae. Copper showed strongly positive results in concentrations between 2×10^{-6} to 5×10^{-7} molar, while both iron and aluminum required concentrations of 2×10^{-4} molar to give equivalent results.

230. THE CYTOLOGY AND HISTOCHEMISTRY OF OOCYTES IN FUNDULUS HETEROCLITUS. Mary J. Guthrie, Eugenie V. Mârza and V. D. Mârza, University of Missouri and Faculty of Medicine at Jassy, Rumania. (Introduced by W. C. Curtis.) (Charts and lantern; 15 min.)

Considerable cytoplasmic increase occurs in the oocyte before the appearance of proteinaceous yolk vesicles. These are transformed into fatty yolk which, also, is formed directly in the cytoplasm. Inorganic iron, detected with the aid

of ammonium sulfide and potassium ferrocyanide, is not present in the nucleus at any time and does not occur in the cytoplasm until proteinaceous yolk, which also gives a faint reaction, begins to appear. Total iron localization, revealed by micro-incineration, shows that fatty yolk contains organic iron. A quantitative determination of potassium by the method of Macallum, modified by Mârza and Chiosa and with the use of their micro-comparator, shows potassium to be most abundant in the cytoplasm and nucleoli of the smallest oocytes. During yolk formation the proportion of potassium diminishes conspicuously. The plasmal reaction of Feulgen is more intense in proteinaceous than in fatty yolk and negative in the nucleus. The nucleal reaction is negative in the nuclei of the smallest oocytes and throughout the growth period; oocytes undergoing meiosis have not been observed. Both proteinaceous and fatty yolk give a positive nucleal reaction. Identified by the method of Unna for acid proteins, only globulins are present in the cytoplasm and nucleoli before yolk appears; they are abundant. The amount of globulin in the cytoplasm decreases as yolk is formed. Albumins are demonstrable in the cytoplasm as yolk forms. Proteinaceous yolk contains only globulins; fatty yolk, neither albumins nor globulins. Both types of yolk contain nucleo-proteins, which cannot be demonstrated in the nuclei.

231. A CORRELATION OF THE AMOUNTS OF THE GONADOTROPIC SUBSTANCES IN THE PLACENTAE, BLOOD AND PITUITARIES OF MARES IN VARIOUS STAGES OF PREGNANCY. Arthur A. Hellbaum, University of Wisconsin. (15 min.)

The gonad-stimulating ability of the pituitaries, blood and chorionic placentae, respectively, of sixteen mares in different stages of pregnancy, was assayed. In early pregnancy, the gonadotropic complex of the pituitaries exhibited a marked decline in activity, at which time the concentration of the active principles in the blood was greatly increased. As pregnancy advanced, the gonad-stimulating activity of the pituitary again increased to an amount considerably greater than that found in the pituitaries of non-pregnant mares, while that of the blood gradually diminished. There followed another slight decline in the gonadotropic activity of the pituitary until just before parturition when it increased and was about the same as that in the average non-pregnant mare.

The concentration of gonad-stimulating substance in the allanto-chorion in the different periods of gestation was similar to that found in the blood of the pregnant mares, except that its appearance and maximum concentration occurred somewhat later. It also persisted some time after the activity had practically disappeared from the blood.

232. CHANGES IN ELECTRICAL IMPEDANCE AND PHASE ANGLE OF GRASSHOPPER EGG MEMBRANES DURING DEVELOPMENT. Theodore Louis Jahn, State University of Iowa. (Lantern; 10 min.)

Impedance values of egg membranes of Melanoplus differentialis were measured for individual flattened membranes by balancing the impedance of 2 mm.^{2} of membrane with that of a parallel resistance-capacitance circuit in a Wheatstone bridge at 1 kilocycle.

During early development (1 to 6 days at 25°C.) the membranes consist only of the chorion which has a resistance of about 2500 ohms but no capacitance (phase angle = 0°). From the seventh to eleventh days the cuticular layers are secreted, and the resistance and capacitance necessary for balance increase to about 200,000 ohms and 2500 $\mu\mu$F. This is an impedance of 61,000 ohms with a phase angle of —72°. These data vary considerably with individual eggs, but the average values remain approximately constant from the eighth day of development until hatching. These results indicate that the impermeability of the egg covering to ions is caused mostly by the yellow layer of the cuticle which seems to be the source of capacitance in the circuit, and that this high degree of impermeability is maintained throughout development. Therefore, the increase in volume and water content which occurs must be caused by an increase in the amount of osmotically active substances in the egg rather than by a change in permeability. If a two-plate condenser structure and a parallel circuit are assumed for the yellow cuticle the calculated dielectric constant is approximately equal to that of water.

233. The effect of aeration and lack of CO_2 on growth of protozoa in bacteria-free culture. Theodore Louis Jahn, State University of Iowa. (Lantern; 5 min.)

Bacteria-free cultures of Glaucoma piriformis and Chilomonas paramecium were grown in heavily buffered peptone-phosphate media at pH 6.0 under the following conditions: a) unaerated, b) aerated with ordinary air, c) aerated with CO_2-free air. Aerated cultures showed lower growth rates but a longer growth period than unaerated cultures. Glaucoma apparently was unaffected by lack of CO_2, but the number of Chilomonas present in CO_2-free cultures was always less than one-fifth that in the controls aerated with ordinary air. CO_2, therefore, seemed to be necessary for rapid growth of Chilomonas, and this is the first demonstration of this necessity for an organism other than bacteria.

These results, as well as those of other workers with bacteria, may be explained on the theory that the carbonate content of organisms which ordinarily live in a medium of high CO_2 concentration (bacteria and Chilomonas) is relatively much more important as a buffering system than is that of organisms which ordinarily do not live in such media. The retardation of growth in CO_2-free media, therefore, would be caused by an unfavorable intracellular pH due to lack of CO_2. A decrease in this effect in the presence of peptone (reported for bacteria) might be explained by the formation of weak acids (partly undissociated at pH of medium) from protein hydrolysis which are capable of partially replacing CO_2. Failure of phosphate to replace CO_2 might be explained by an impermeability of the cell membrane to phosphate ions.

234. Growth of follicles in the ovary of Myotis lucifugus lucifugus. Katherine R. Jeffers, University of Missouri. (Lantern; 12 min.)

The single follicle of the spring ovulation is recognizable in the bat ovary in late October when it contains a small antrum. Follicles in other stages of growth and degeneration are also present. To determine the character of the growth of the smaller follicles in the presence of the vesicular follicle, all the

follicles in the ovaries of forty-five bats collected from late October to the middle of April were measured and counted, and the numbers of follicles falling in certain size groups recorded. Marked variation in the total number of follicles in single individuals and in the follicles of any size group occurs, but when the data for bats collected during a given period are combined, well-defined variations in the numbers of follicles of different sizes are evident throughout the hibernation season. The curve for follicles 24 to 63 μ in diameter shows three distinct waves during the period studied, with indications that a fourth occurs. Similar waves in the curve of follicles 64 to 103 μ in diameter can be correlated with those of the small follicles. Follicles 104 to 163 μ in diameter vary in number, but the variations cannot be correlated with those of the smaller follicles, since it is in such follicles that degeneration begins. The data indicate that there are periodic waves of growth and degeneration of non-vesicular follicles although the vesicular follicle is present and undergoes only slight change until the time of ovulation.

235. The contractile vacuole of Paramecium multimicronucleata. R. L. King, State University of Iowa.

Each contractile vacuole system of Paramecium multimicronucleata is made up of a number of components, some temporary and others permanent. The contracting vacuole with its membrane is a temporary structure as are the vesicles which fuse to form it. The vacuole discharges its contents to the exterior leaving a vestige closing the pore. The pore, with its discharging tubule and the feeding canals are permanent cell organelles. The feeding canals end in injection tubules which extend up to the pore. The vesicles, which later fuse to form the vacuole, are formed at the proximal end of the injection canals, leaving a membrane closing the canal, much as a food vacuole is formed at the gullet. The canal-fed contractile vacuole of Paramecium is very similar to the vesicle-fed vacuole of Euplotes both as to its origin and its fate. The Nassonov homology is rejected.

236. Further studies on the ameba found in grasshoppers. R. L. King and A. B. Taylor, State University of Iowa.

Malpighameba locustae has been found in the epithelial cells of the gastric caeca and mid-gut as well as in the lumen of the malpighian tubes of grasshoppers. About 2,000,000 cysts of the parasite are egested daily by heavily infested male Melanoplus differentialis; 3,000,000 daily by the female. Since the male weighs about two-thirds as much as the female, the number of cysts egested is roughly proportional to body weight.

Thirty-seven species of Acrididae (five Acridinae, thirteen Oedipodinae, and nineteen Cyrtacanthacrinae) have been infested with this parasite in the laboratory. Infested individuals are very rare in the field: two individuals of 633 specimens (fifty-one species represented). In areas 'seeded' with cysts of the parasite, twenty individuals of 422 specimens examined (twenty species represented) were found positive.

237. Effects of various experimental procedures on survival and weight loss of 'two-stage' adrenalectomized rats. Robert L. Kroc, Indiana University. (Lantern; 10 min.)

Castration of females and males before adrenalectomy increased the average survival period only about 2 days over that of the non-castrated controls. The castrated females lost an average of about 4 per cent less weight, and the castrated males approximately 4 per cent more than their non-castrated adrenalectomized controls.

Injections of theelin in small amounts in non-castrated adrenalectomized females appear to increase the average survival period and to raise the lower limit of the range but not the upper. Gradual increase in theelin up to 12 R.U. daily following the second operation raised the average survival period nearly 5 days above the 14.3 days for the controls. Three additional groups of females, receiving 5, 10 and 16 R.U. daily, showed survival averages inversely proportional to the dosage. A fifth series receiving increasing daily injections before and after each operation showed an extended survival period.

Theelin injected daily in castrated and normal males shortened the survival period as compared with controls. Six females injected twice daily with Antuitrin-S survived approximately 4 days longer than their controls.

Theelin has been found effective in producing vaginal smears characteristic of oestrus in adrenalectomized and castrated-adrenalectomized females after marked weight losses.

Rubin-Krick solution was ineffective in maintaining the lives of adrenalectomized and castrated-adrenalectomized males when given as their only source of drinking water, but the average survival periods were approximately 3 days longer than in the controls.

Of 148 animals used in these experiments, only four females and one male survived adrenalectomy. A weight loss of 14 per cent in any untreated adrenalectomized rat of this strain has been found a reliable criterion that the animal will not survive.

238. Ultracentrifugation of intranuclear inclusions produced by viruses. Alfred M. Lucas and Walter W. Herrmann, Iowa State College and State University of Iowa. (Lantern; 10 min.)

See abstract no. 239.

239. Ultracentrifugation of Intranuclear Inclusions Produced by Viruses. Alfred M. Lucas and Walter W. Hermann, Iowa State College and State University of Iowa. (Lantern; 10 min.)

Herpes virus: Inoculation was made on the cornea of rabbits. Tissues containing intranuclear inclusions were centrifuged for an hour at about a half million times gravity and afterward fixed in Zenker's fluid. The materials within the nucleus arrange themselves in strata; the intranuclear inclusion on the centripedal side, the nuclear sap in the middle, and the chromatin on the centrifugal side. When, by centrifugation, the marginated chromatin has been brought to one pole it appears that the quantity of chromatin is not much less than in the normal

nucleus. Normal, uninfected nuclei separate into two substances, nuclear sap and chromatin. No materials were concentrated at the centripedal pole which, by their staining reaction, suggested that they might be a precursor of or some antecedent material in the formation of an inclusion body.

Submaxillary gland virus: The intranuclear inclusion of infected submaxillary gland of ground moles and guinea pigs, when centrifuged, is thrown to the centrifugal pole and carries with it, chromatin which adheres to its surface.

240. The Consequences of Sigmoid Growth for Relative Growth Functions. Hyman Lumer, Western Reserve University. (Introduced by A. H. Hersh.) (10 min.)

Huxley's relative growth function, $y = bx^k$, is derivable on the assumption that both x and y increase exponentially with time. If it is assumed that the growth curves of these parts are sigmoid, conforming with a) the autocatalytic or logistic curve, or b) the Gompertz curve, the derived relative growth functions are rather complicated. Each has, however, a parabolic function as a first approximation.

In case a), $\frac{d \log x}{d \log y}$ varies continuously from a finite positive value to zero, a different positive value, or infinity, depending on whether the ratio of the velocity constants, $k, > = < 1$. In case b), $\frac{d \log y}{d \log x}$ varies from infinity to zero, or from zero to infinity with increasing values of x, as $k > < 1$. If $k = 1$, $\frac{d \log y}{d \log x}$ is constant.

Thus a constant coefficient of growth partition is approximately realized in a) for small values of x and y; and in b) for values of k close to one. Also, a close approximation may be obtained for data covering a segment of the total growth curve, when graphical methods are employed. The concept of a constant coefficient, however, cannot be applied over the whole duration of sigmoid growth. Moreover, considerable caution must be exercised in attempting to assign biological significance to 'breaks' in relative growth curves. Several instances of deviations from Huxley's equation have been found, which are explicable on the basis of the above analysis.

241. On the Lethal Dose of Electric Current for Paramaecia Basile. J. Luyet, Saint Louis University. (Cinema; 12 min.)

Paramaecia were introduced into capillary tubes of such diameters that the organisms were held immotile, wedged between the walls of the tube, the remainder of the bore being filled with the culture medium. Direct currents of increasing intensities were then passed through the tube. The response of the Paramaecia was observed under the microscope and the maximal non-lethal dose of current determined. The average results of fifty-four good determinations show that a flow equivalent to the passage of 17.10^{11} electrons per second, through the Paramaecium, kills it in less than $\frac{1}{8}$ of a second.

242. The temperature coefficient of the inherent E.M.F. of Valonia. Gordon Marsh, State University of Iowa. (Introduced by J. H. Bodine.) (Lantern; 15 min.)

The effect of temperature upon the steady level of the inherent potential of impaled cells of Valonia ventricosa was measured potentiometrically between 6° and 36°C. Temperature was controlled in a water bath to less than 1°C. The mean values of the Q_{10} for four temperature intervals in this range were: (6.4 to 19°) 4.15 ± 0.82; (16.4 to 28.4°) 1.9 ± 0.07; (19 to 30°) 1.85 ± 0.05; (26 to 36°) 1.62 ± 0.04.

It is concluded that the normal E.M.F. of Valonia cannot be due to a simple diffusion potential nor to any other system in thermodynamic equilibrium, since that would entail proportionality between the E.M.F. and the absolute temperature. It is possible to show that the conditions of the flux equilibrium of the respiratory reactions which are the basis of Lund's oxidation-reduction theory of bioelectric potentials are such as to produce the Q_{10} effect, provided there is a polar difference across the protoplasmic layer in the velocity characteristics of the different reactions. Evidence for the existence of this polar effect of temperature is found in the time: potential curves of transition from one temperature to another.

243. The fetal membranes and mammalian phylogeny. H. W. Mossman, University of Wisconsin. (Lantern; 15 min.)

A comparative study of the morphogenesis of the fetal membranes of relatively well-known and well-defined mammalian groups such as Rodentia, Carnivora, Anthropoidea and Artiodactyla shows that the membranes offer valuable criteria of phylogenetic relationships, if their characters are properly evaluated. Depth of implantation, method of amniogenesis, degree of germ layer inversion and placental shape usually vary within orders and often even within families, and may therefore be used only to indicate intraordinal or intrafamilial affinities. Orientation of the embryonic disc to the uterus at implantation, size and character of the yolk sac and allantois, and the fundamental morphology of the placenta ordinarily are constant within orders but vary between them and may therefore be used to determine interordinal relationships. A phylogenetic tree based on these principles agrees closely with those based on paleontological and other evidence, but is, of course, subject to many errors and misinterpretations due to lack of information or incorrect information about the membranes of some groups. Some of the more striking things that have emerged from this study are: the wide differences between the Megachiroptera (flying foxes) and Microchiroptera (bats); the similarity of the Myrmecophagidae (New World ant-eaters) to the Bradipodidae (sloths) and the wide divergence of both of these from the Dasypodidae (armadillos) which resemble Rodentia, and from the Manidae (scaly ant-eater) and Tubulidentata (aard-vark) which resemble the Ungulates; the similarity of Sirenia (dugong), Cetacea (whales) and Lemuroidea to the Ungulates and the wide divergence of Lemuroidea from the Tarsoidea and Anthropoidea.

244. Abnormalities of the vertebral column of carp and other Illinois fishes. D. John O'Donnell, Illinois Natural History Survey. (Introduced by David H. Thompson.)

Abnormalities of the spinal column are frequently found in carp, crappies, gizzard shad, bullheads, mud cat, channel cat and the great northern pike. The bone constituents are dissolved away and redeposited in a manner similar to tuberculous conditions in humans. It results in a curvature of the column laterally or dorso-ventrally, or a section of the column may telescope. It is believed that this condition comes about quite suddenly and in epidemic form, because in some years it is found much more frequently than in other years. Most of the fish have been taken from the Illinois river and its bottomland lakes within a stretch of 90 miles. The cause is unknown.

245. The effect of temperature, ortho-di-chlor-benzene and ether on the respiration of Mediterranean flour moth larvae (Ephestia kühniella Zeller.) Nellie M. Payne, University of Minnesota. (Lantern; 15 min.)

None of the agents mentioned was able to alter the respiratory quotient appreciably as long as the effects of the agent were reversible. Ortho-di-chlor-benzene increased the intensity of respiration; ether lowered it. The former reagent, however, left the insects in a stiff tense condition. They were motionless but held their heads in a sphinx-like pose. The larvae treated with ether were limp and flaccid. Recovery from the chemical agents was complete as tested by the result that the treated larvae not only were able to resume movement but were able to pupate and to emerge as normal adults. At low temperatures the effects of the chemical agents on intensity of respiration were not as marked as at high but at none of the temperatures used was the effect of the chemical agent entirely absent. Extreme low or extreme high temperature lowered the intensity of respiration. The reagents used lowered the intensity of respiration still further at extreme temperatures. Thus the final effect of temperature and either ortho-di-chlor-benzene or ether was additive.

246. Observations of centrioles in turtles. Paul L. Risley, State University of Iowa. (Lantern; 10 min.)

Centrioles in germ cells of five species of turtles (Sternotherus odoratus, Graptemys pseudogeographica, Chelydra serpentina, Chrysemys picta bellii, and Malaclemmys centrata centrata) appear as short rods. Two rods may be joined at one end to form a 'V,' which is the characteristic arrangement at each pole of the spindle in dividing spermatogonia. Each 'V' is formed from a single rod by a process of outgrowth from a generating end of the rod; one arm of the 'V' represents the parent centriole, the other the daughter centriole. This confirms the observations of the Schreiners ('05) on the method of centriolar multiplication in Myxine.

In primary spermatocytes, a pair of rods (a 'V') appears through synapsis; the rods separate on emergence from synapsis, and an outgrowth from each again occurs, two 'V's' appearing in diakinesis stages. A single 'V' enters each secondary spermatocyte and separates into two rods in the interkinesis period. A single longer rod appears at each pole of the second maturation spindle and passes into the spermatid.

In spermioteliosis the long rod rotates until one end meets the posterior end of the elongating nucleus and the opposite end meets the cell membrane, thus defining the axis of the middle piece. The peripheral end gives rise to the flagellum, and the nuclear end forms a ring-shaped centriole that encircles the rod and migrates distally.

Rod-shaped centrioles have been observed in germ cells of 7.0 mm. embryos preceding sex differentiation, young females, and both young and adult males. Somatic cells show only centrioles of granular type.

247. Osmotic pressure and the development of Melanoplus differentialis. Arthur L. Schipper, State University of Iowa. (Introduced by J. H. Bodine.)

Aerated glucose and balanced salt solutions are used in this work. Eggs are kept at a constant temperature and development noted. It is found that development proceeds even at high osmotic pressures (around 80 atmospheres) although the development is retarded considerably as compared with controls. Development in unaerated solutions (regardless of concentration) resembles that which is found in high osmotic pressures. That retardation in unaerated hypertonic solutions is not due to osmotic pressure is proven by the fact that similar results are noted in unaerated isotonic solutions. The effects on the development of eggs, first kept in hypertonic solutions and then transferred to isotonic solutions, are being studied.

248. Is Diphyllobothrium cordiceps (Leidy, 1871) a valid species? John W. Scott, University of Wyoming. (Lantern; 10 min.)

Fifteen large, fully mature worms, without abnormalities, were selected for study. In this description averages are given, followed by range, in parentheses. With characters of the genus. Strobila, length 90 (60–192) cm.; width 4.35 (3–10) mm.; widest 25–50 cm. back of head. Proglottides, 653 (441–894), gradually increase in length; at level where eggs appear in uterus average ratio L: W = 1: 2.88 (1.75–4.03); at posterior end ratio may drop to 1: 0.66. Scolex, length 1.83 (1.19–2.19) mm., thickness 0.92 mm. by 0.72 mm. Neck short, length 0.53 (0.31–1.06) mm., occasionally longer; width 0.62 (0.42–0.86) mm. Genital anlage appears in proglottid 57 (36–85). Eggs appear in uterus at proglottid 147 (76–204). In mature proglottides the genital papilla is just within first quartal of proglottid, in very old proglottides it is posterior to first third. Testes in two groups, number 318 (200–477), average diameter 0.115 mm. Cirrus pouch, average length 0.257 mm., width 0.240 mm. Number of uterine loops on each side, variable, 3–12, average 6.14; less variable in individual worms; seldom approach form of rosette except in old proglottides. Average of 100 eggs: length, 65μ, width 41 μ; ratio W: L = 1: 1.58. Distinguished from D. latum and other American species reported by one or more of following characters: Size of strobila, number of proglottides, scolex, short neck, position of genital papilla, number of testes, ratio of width to length of eggs, and levels at which genital anlage begins and eggs appear in the uterus. D. cordiceps appears to be a valid species.

249. The relation of peck-dominance to maze learning and reproduction in the canary Serinus canarius. Hurst Shoemaker, The University of Chicago. (Introduced by Alfred E. Emerson). (Lantern; 15 min.)

Flock organization in canaries is the type described for pigeons and parrakeets (Masure and Allee, '34) and based on peck-dominance rather than 'peck-rights' described for chickens (Schjelderup-Ebbe, '22). Fifteen female and two male canaries were placed together in a cage where observations were made. The males were used in the mating observations but otherwise are not reported in this paper.

The observations (March 12th to April 28th) were divided into six periods of 8 days each, and the birds arranged in rank of peck-dominance for each of these periods. The maze used for testing learning was a simple two-alley problem box. The birds were trained twice daily. In determining reproductive activity the total observed copulations (January 22nd to August 19th) were taken. In correlating the peck-dominance and success in the maze the rank of each bird in the peck order for each 8-day period was correlated with its rank in maze success for the corresponding period using Pearson's coefficient of correlation. A correlation of $r = 0.79 \pm 0.03$ was found for peck rank with time rank and $r = 0.78 \pm 0.03$ for peck rank with error rank. Using the same formula for total peck rank with number of copulations a correlation of $r = 0.76 \pm 0.07$ was found.

250. The development of the mid-intestine in Melanoplus differentialis (Acrididae: Orthoptera). Richard R. Stuart, State University of Iowa. (Introduced by J. H. Bodine.)

A histological study has been made of the developing mid-gut or mesenteron of Melanoplus differentialis from diapause until hatching. The primitive mid-gut consists at first of a single layer of squamous epithelium surrounding the yolk; to this is added later an outer layer. These two layers give rise to the muscular and connective tissue elements of the definitive mid-gut. Near the time of hatching, vitellophages which have been present in the yolk since earlier stages migrate peripherally to form a lining upon the inner surface of the primitive mid-gut. The vitellophage nuclei divide to form the smaller nuclei of the definitive epithelium of the mid-gut. The development of the definitive mesenteron from the primitive mid-gut takes place rapidly and occurs near the time of hatching.

251. A histological study of some abnormal outgrowths of irradiated grasshopper embryos. Richard R. Stuart and Titus C. Evans, State University of Iowa.

A number of 5-day-old grasshopper (Melanoplus differentialis) eggs were irradiated and subsequently were allowed to develop for 3 weeks. The eggs were then killed and the embryos were examined under a dissecting microscope. Later they were prepared and examined histologically. Controls were treated similarly excepting for the irradiation. Some of the treated embryos exhibited abnormal growths, particularly in the head region, while others showed no visible effect. A comparison, histologically, of ± the abnormal individuals and the controls, of age 3 weeks, reveals an apparent increase in size and number of certain of the nerve cells in the vicinity of the abnormality. Also there seems to be a significant increase in mitotic activity, especially in the nerve cells at the base of the growths.

252. Rhythmic activity of Melanoplus embryos (Acrididae). Effect of light. Vincent Thompson, State University of Iowa. (Introduced by J. H. Bodine.)

Lateral wall contraction rate of Melanoplus differentialis embryos is accelerated by light. This acceleration is most pronounced at about 32°C. Movement in minimal light, after exposure to strong illumination is decreased, sometimes being completely stopped for a short time. The latent period for the effect of illumination varies with the age of the embryo, being longest in younger individuals. Decapitated embryos show this light acceleration. The longer light wave-lengths appear most effective.

253. Spawning integration and the spawning reaction of Nereis limbata. Grace Townsend, The University of Chicago. (Introduced by Horatio H. Newman.) (15 min.)

Special sensory changes accompanying sexual maturity are among the several factors making possible the spawning integration of the marine annelid, Nereis limbata. A special sensitivity of the male to egg water, and to cystine, cysteine, and to glutathione, is developed. This special sensitivity does not exist in the non-sexual phase and is largely restricted to the metamorphosed epitoke. The chemical specificity of the sensitivity is of an extreme degree, extending even to the distinction of levo- and dextro- forms of cystine. Accompanying the change in chemical sensitivity is a new degree of vibratory sense such that the worms are able to orient themselves with reference to objects and to avoid collisions. There is evidence this sense is specialized in the dorsal and ventral cirri of the parapodia.

The spawning reaction consists of complexly coordinated reflexes. The characteristic circling and general orientation of the worm to the source of chemical stimulation is dependent upon the cerebral ganglion, the swimming is dependent upon the suboesophageal ganglion, while the peristalic and parapodial movements can be carried on by the segmental ganglia alone.

Factors influencing the spawning reaction, in addition to the general factor of sexual maturity, are: temperature, acid and alkali, and the physiological state induced by swimming. The quiescent worm cannot be induced to spawn by chemical stimuli normally effective for the swimming worm.

254. The use of the embryonic rectal processes of the embryos in a revision of the classification of the family Goodeidae. C. L. Turner, Northwestern University.

In 1932, after an examination of the embryos of six species, a report was made of the peculiar rectal processes found in the embryos of the Goodeidae, a family of Cyprinodont fishes inhabiting central Mexico. Since 1932, gravid female specimens of all of the twenty-four species of the family except two have been examined and the rectal processes have been found in the embryos of all but one species. The additional material was obtained from the collections in the Field Museum and from new specimens collected by the Museum of Zoölogy, University of Michigan. Morphological peculiarities of the rectal processes in each species

are so distinct that it is possible to use them for taxonomic purposes. Hubbs and Turner are undertaking a revision of the classification of the family, using the peculiarities of the rectal processes and of the ovaries as a basis. The new classification, differing considerably from older ones, is believed to express basic phylogenetic relationships.

255. The cytology of developing muscle. Isabelle G. Weed, State University of Iowa. (Introduced by H. W. Beams.)

Development of myofibrils in myotome muscle of chick embryos may be divided into two phases. During the first, with which the present observations are concerned, 'primary' fibrils arise in the cytoplasm of the presumptive muscle cells. During the second period the number of myofibrils increases, apparently by splitting of the primary fibrils.

At the beginning of the first phase, filamentous mitochondria become oriented parallel to the long axis of the myoblast, and coincidentally, homogeneous, unstriated, lightly staining fibrils arise in the cytoplasm. Fibrils and mitochondria are closely associated, suggesting that the mitochondria may play an indirect part in fibril formation. However, the fibrils are apparently formed from the many granules (distinguishable from mitochondria) which at first fill the cytoplasm. The granules disappear progressively as the fibrils appear, and the cytoplasm becomes clear.

During this time the nuclei become large, stain lightly, and divide amitotically without division of the cytoplasm. The nucleoli are prominent and apparently divide before division of the nucleus. The Golgi material (plentiful at this time) extends in long streamers from the ends of the nuclei.

The close of the first developmental phase is marked by decrease in size of nuclei and nucleoli, and decrease in amount of Golgi material associated with each nucleus. The Golgi material now exists as a small cap of material at each end of the nucleus. The primary fibrils (now striated) are situated at the periphery of the muscle cell.

256. Prolongation of breeding capacity in males of an annual breeding wild rodent (Citellus tridecemlineatus) by constant low temperature. L. J. Wells, The University of Chicago and University of Missouri. (Lantern; 15 min.)

Results of experimental studies have indicated that the annual sexual cycle in males of this species is regulated by periodic activity within the anterior pituitary gland, pituitary periodicity being controlled at least in part by an environmental factor other than light.

In attempting to determine this environmental factor, fifty-four males were subjected to constant temperatures (4°C. which induced intermittent hibernation and 15.5°C. which barely prevented torpidity) for periods ranging from 3 to 7 months. Treatment, involving young males and adults, occurred during the period of low sexual activity and during the breeding season.

Testes and accessory reproductive organs were studied at frequent intervals by manual palpation, and were recovered at autopsy for histological study. Reproductive organs from experimental males were compared with those of

experimental controls (subjected to simultaneous manipulations of temperature and illumination) and of normal males from the field, the laboratory and outdoor terranean pens.

Nine males placed in the 4°C. room during the breeding season, without exception, failed to undergo sexual regression and remained in a breeding state until autopsy, which occurred from 2 to 5 months after control animals had undergone sexual involution.

Low temperatures during the season of low sexual function failed to accelerate the appearance of sexual activity. Males at 4°C. developed sexually, but the peak in reproductive capacity was attained about 3 weeks later than in control animals.

257. Catalase activity throughout the embryonic development of the grasshopper, Melanoplus differentialis. Margarita Williams, State University of Iowa. (Introduced by J. H. Bodine.) (Lantern; 10 min.)

A study has been made of catalase activity throughout the embryonic development of the grasshopper, Melanoplus differentialis. It was found that when eggs are kept at 25°C., their catalase activity remains low and fairly constant during the first 8 days after laying. It rises from the eighth to the twenty-first day, or to the end of pre-diapause, and is level from the twenty-first to the thirtieth day (early diapause). Catalase activity steadily increases from the thirtieth to the fortieth day, when it reaches the maximum retained throughout the remainder of diapause. During the first 5 days of post-diapause development, catalase activity remains at the level shown in early diapause (21 to 30 days). Beginning with the sixth day after diapause it increases rapidly to reach the maximum at the time of hatching.

Exposure to cold (5°C.), whether occurring in pre-diapause, or in diapause, seems to have no effect on catalase activity.

By division of eggs into embryos, and yolk plus extra-embryonic fluids and membranes, it was found that before yolk-engulfment, most of the catalase is contained in the yolk portion. After engulfment this situation is reversed.

No correlation was observed between catalase activity and the previously established changes in respiratory rate and cellular activity of the egg.

258. Nuptial colorations of the bills of birds and their control by sex hormones. Emil Witschi and R. P. Woods, State University of Iowa. (Lantern; 7 min.)

It is known that in some birds the color of the bill changes on approach of the breeding season. A special study has been made in the case of the common house sparrow. Castrates and birds out of the breeding season have light brown bills. During the breeding season the bills of males are jet black and also those of the females darken to some degree. The bills of castrates and of all birds out of the breeding season darken upon the injection of male sex hormone extracted from human urine. In the course of daily injections of 0.1 rat units (or about 0.05 comb units) the color reaction on the bill is often observed as early as the third day. On the fifth day the reaction is very distinct. The sparrow bill is, therefore, the most delicate indicator for male sex hormone, so far available.

The histological study reveals that upon hormone injection melanin in the form of rod-shaped granules is produced by special pigment cells. It is transferred through a system of cell processes into the growing epidermal cells. As the latter cornify, the pigment is carried toward the surface of the bill. Upon discontinuation of the injections, pigment production is interrupted. Within about 1 month, the pigmented parts wear off and become replaced by new, unpigmented layers of horny substance.

259. CYCLES OF HYPOPHYSEAL ACTIVITY AND THE CONTROL OF PLUMAGE CHARACTERS IN BIRDS. Emil Witschi, State University of Iowa. (Lantern; 8 min.)

In adult birds one may distinguish conveniently two types of plumage; that of the hen and that of the cock. There are species in which both sexes carry a cock's plumage and others in which both carry a hen's plumage all the time. In a third group the female has constantly a hen's plumage and the male a cock's plumage, and in a fourth group the females always stay henny while the males put on a cock's plumage during the breeding season. Finally in a fifth type both sexes change from the hen's to the cock's plumage. Besides these, one finds further variations which obviously link the main types. Castration and injection experiments prove that the seasonal changes in plumage types in such species as the indigo bunting and certain African weaver finches depend directly on cyclical hypophyseal activity rather than on sex hormones.

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